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FOOT AND
ANKLE INJURIES



- MAY NOT GET THROUGH IT ALL!
- INTERRUPT!
- PDF ON WEBSITE

CONTENTS

ANKLE FRACTURES

LISFRANC

ACHILLES RUPTURE

LATERAL AND SYN LIGAMENTS

BASE 5TH



AIM

- ENHANCE UNDERSTANDING
 - HOW NOT TO MISS
 - DISCUSS REHAB

ANKLE FRACTURES

FRACTURE INVOLVING THE
MALLEOLI

YOUNGER (MEN)

OLDER (WOMEN)

ISOLATED LM 70%

ANATOMY



■ Talocrural angle

8-15 °.

Smaller is
fibular shortening.

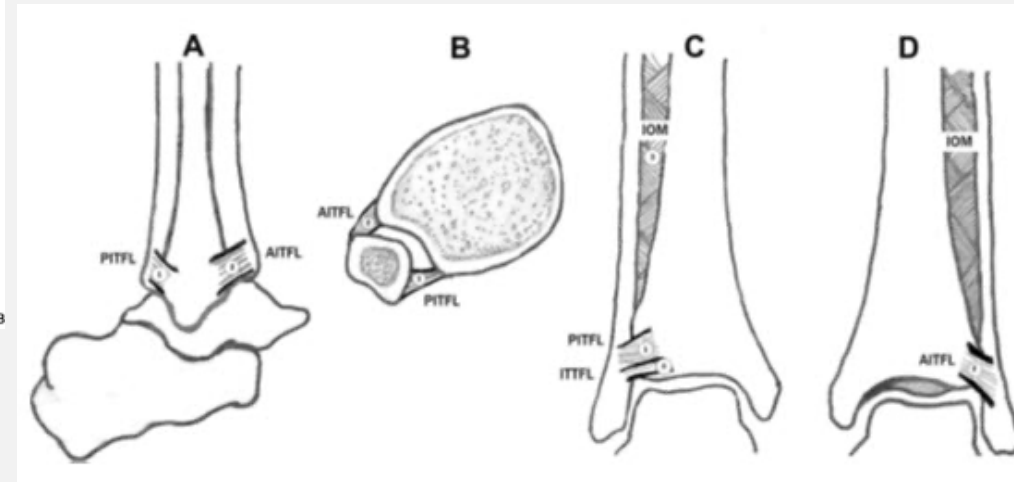
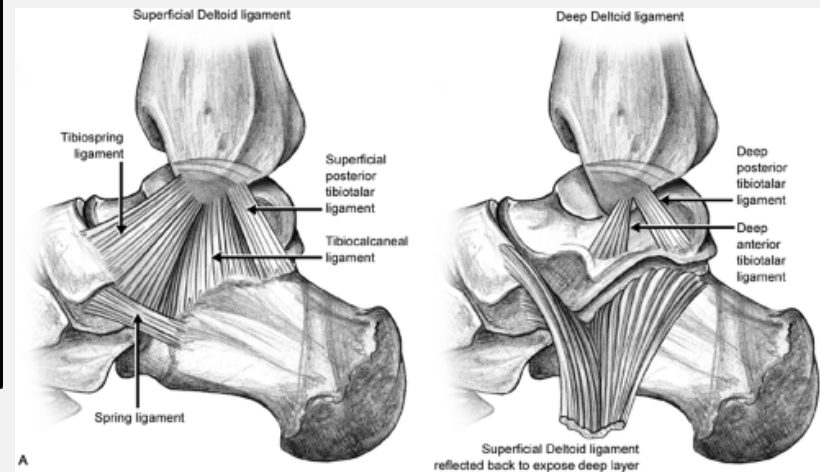
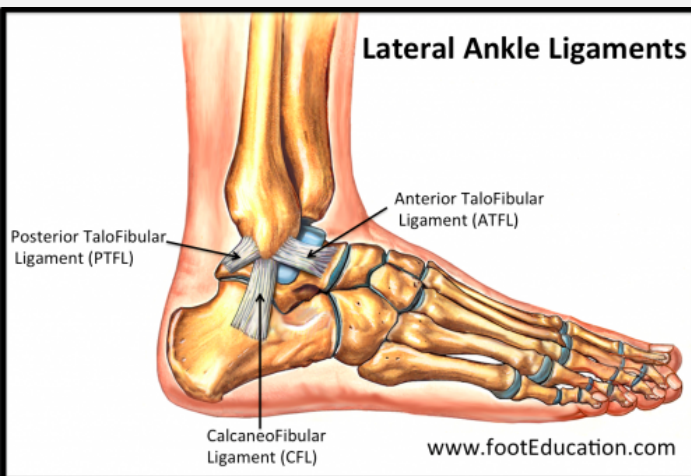


Normal talocrural
angle



Small talocrural
angle

ANATOMY



CLASSIFICATION

DANIS-WEBER

- LEVEL OF FIBULA FRACTURE
- INCREASING INSTABILITY
- SIMPLE

LAUGE HANSEN

- MECHANISTIC
- MORE COMPLEX BUT SIMPLE

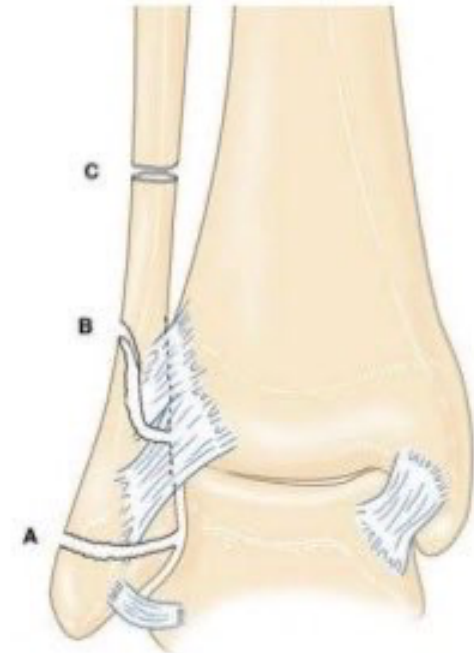
AO

- HARD TO REMEMBER!

WEBER

Weber classification

- Level of fibular fracture relative to the syndesmosis
- A = below syndesmosis
- B = level of syndesmosis
- C = above level of syndesmosis

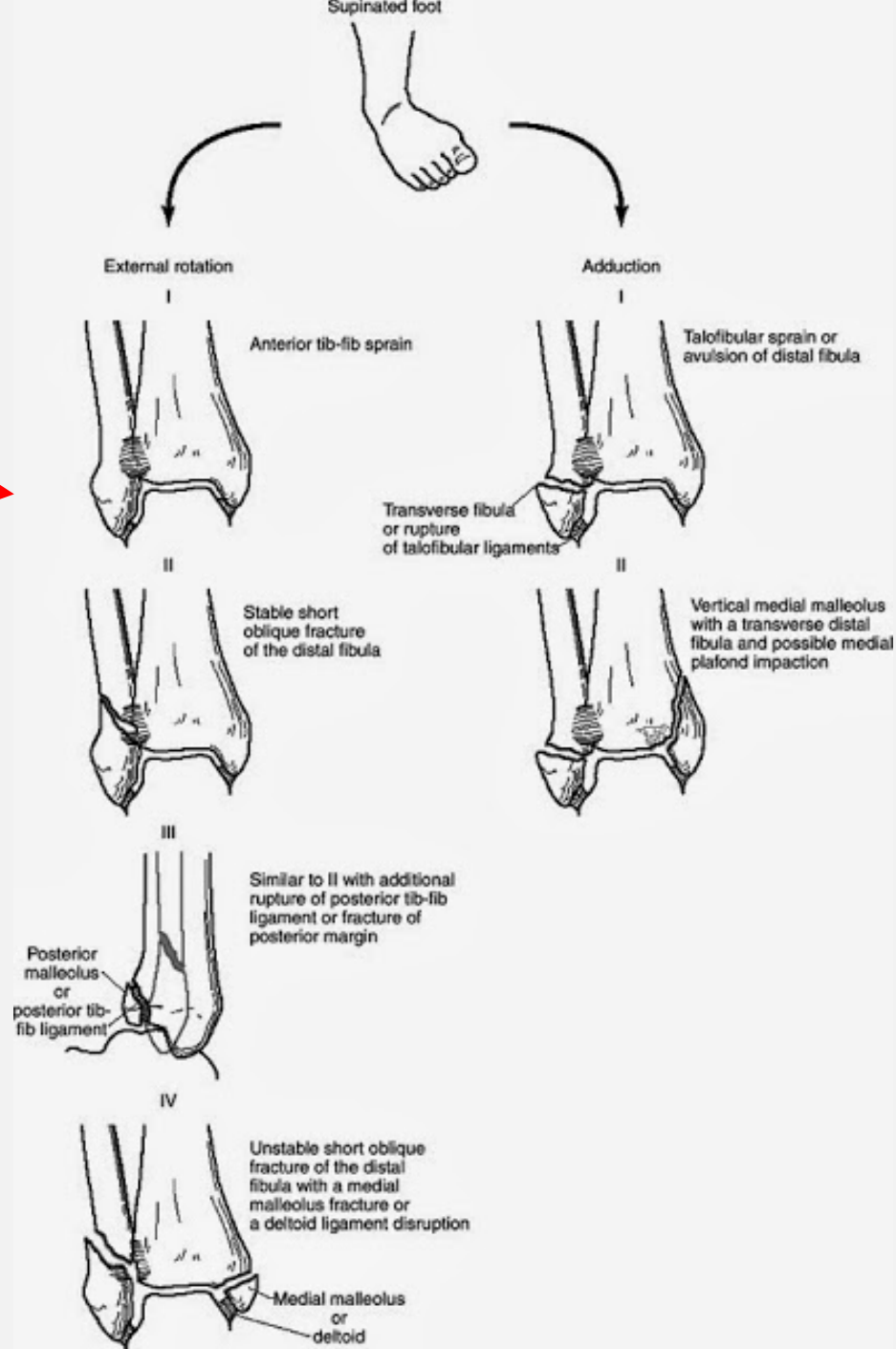


LAUGE HANSEN

- POSITION OF FOOT
 - SUPINATION OR PRONATION
- FORCE THAT HAPPENS TO TALUS
 - = SUPINATION EXT ROT, SUPINATION ADDUCTION
 - = PRONATION EXT ROTATION, PRONATION ABDUCTION



CLOCKWISE



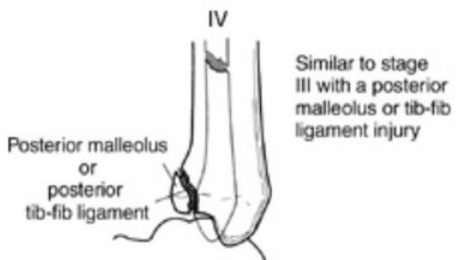
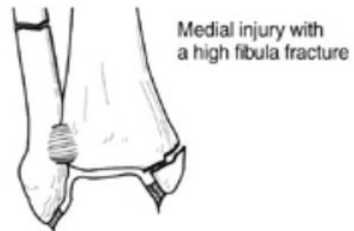
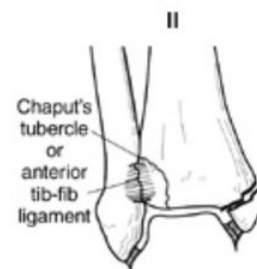
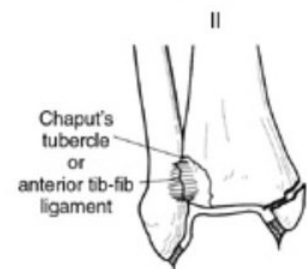
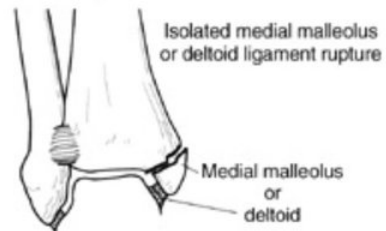
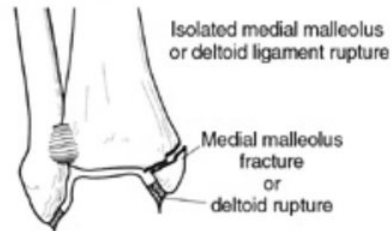
CLOCKWISE



Pronated foot

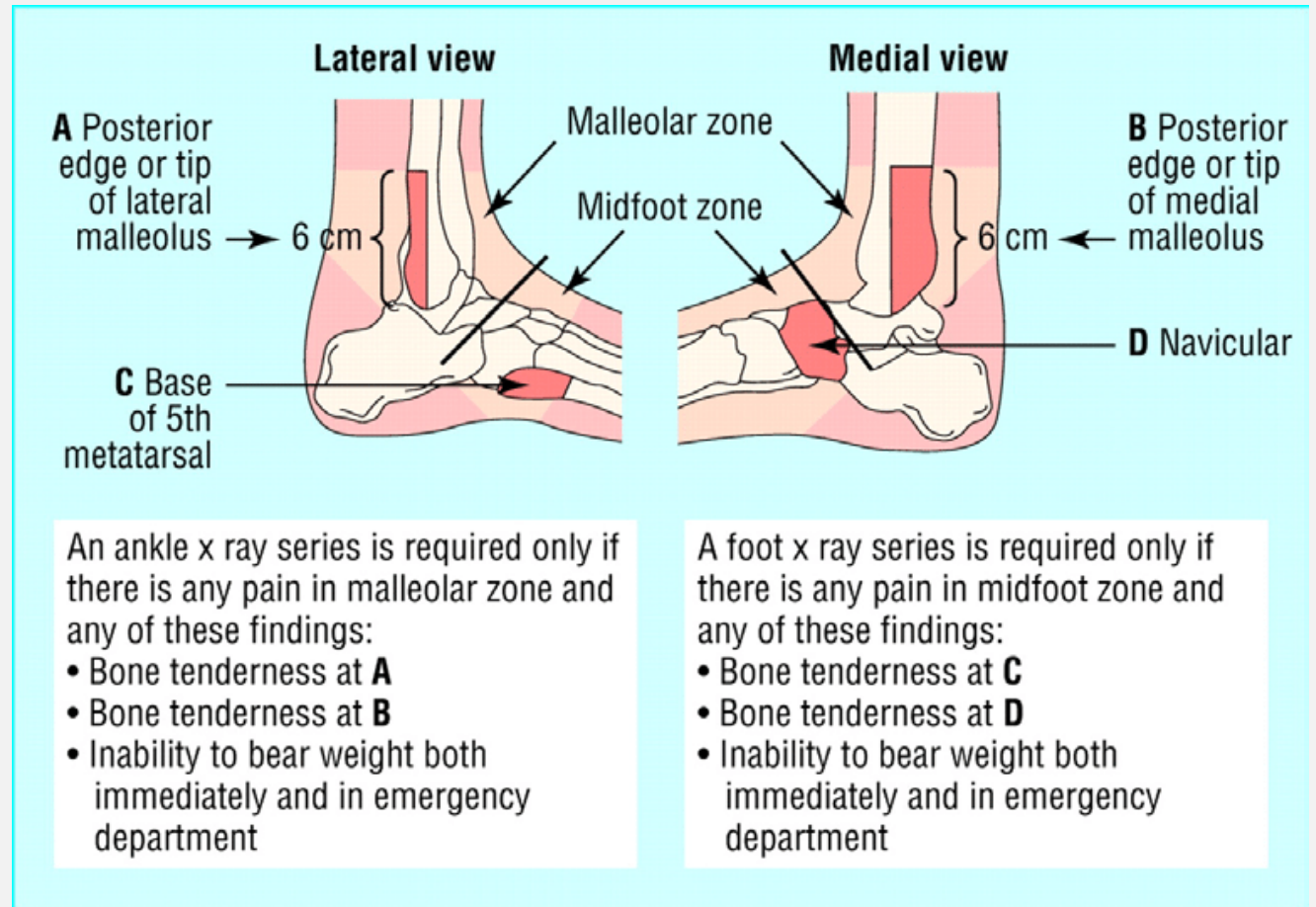
External rotation

Abduction



DIAGNOSIS

- CLINICAL
- MEDIAL BRUISING
- BRUISING PAIN UP SYNDESMOSIS
- KNEE
- SWELLING
- NV
- OTTOWA ANKLE RULES



IMAGING

AP, MORTICE, LATERAL ANKLE
CONSIDER AP KNEE

OFTEN
NWB.

WB USEFUL

CHECK NOT
IN EQUINUS



LOOK AT LATERAL MALL, MEDIAL MALL
AND DELTOID, SYNDESMOSIS

■ XRAY

**TIBIOFIBULAR OVERLAP (1cm. 6MM VS 1MM),
TIBIOFIBULAR CLEAR SPACE (1cm. 6MM),
MEDIAL CLEAR SPACE (mortice, 4.5MM),**

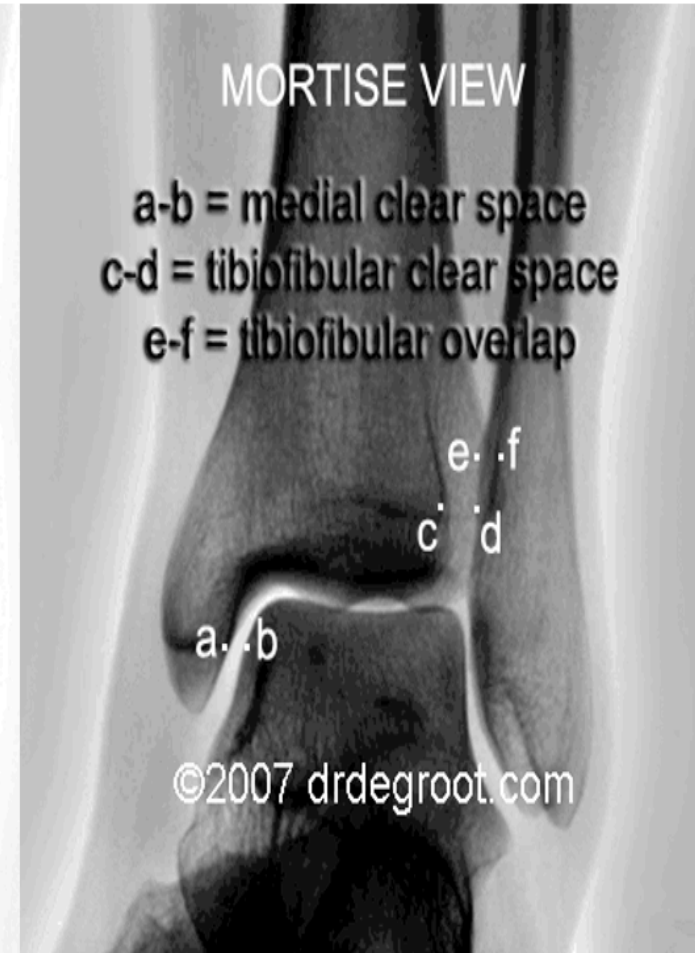
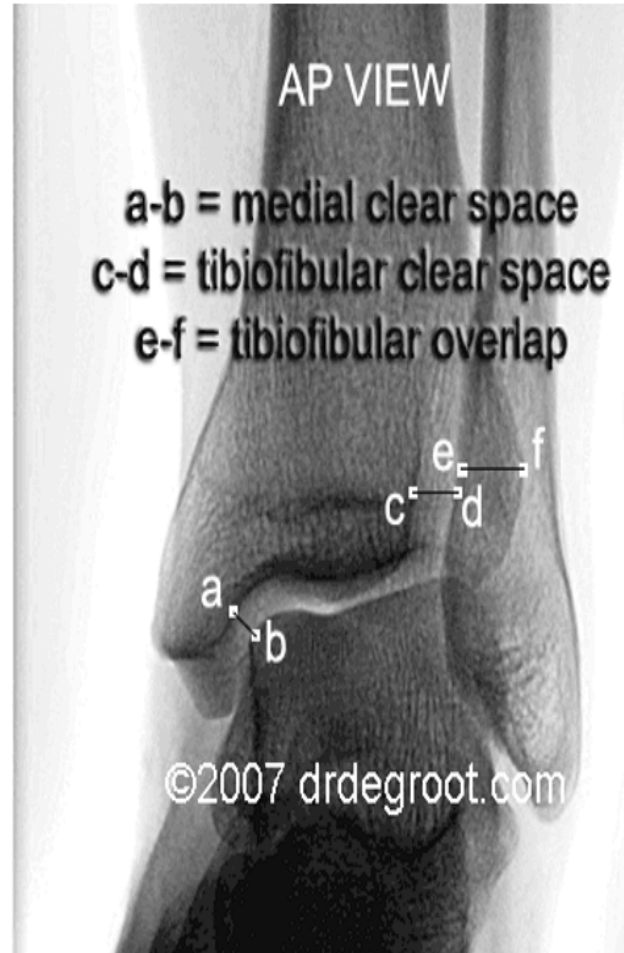
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WEIGHT BEARING

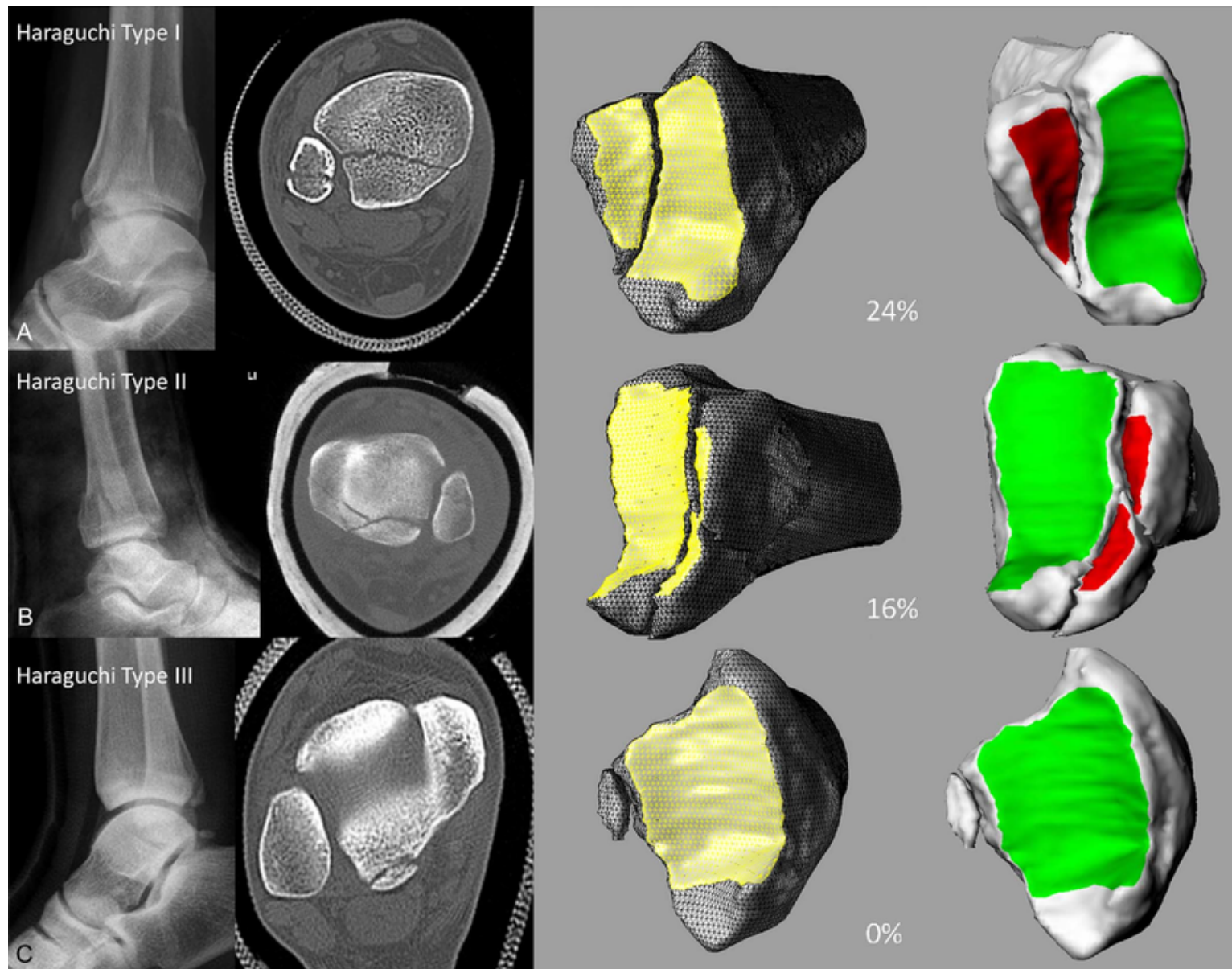
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**POOR REPRODUCIBILITY,
ROTATION DEPENDENT,
MAGNIFICATION DEPENDENT
POOR SENSITIVITY FOR SUBTLE,
WIDE VARIATION OF NORMAL**

AP VIEW 48% SENS, MORTICE 64%



POSTERIOR MALLEOLUS



INDICATIONS FOR SURGERY

UNSTABLE FRACTURE

- MEDIAL AND LATERAL SIDES GONE
- LATERAL AND SYNDESMOSIS
- 'RING'

DISPLACED FRACTURE

- FIBULA SHORTENED, ROTATED.
- 3MM DISPLACEMENT FIBULA FRACTURE

STABILITY

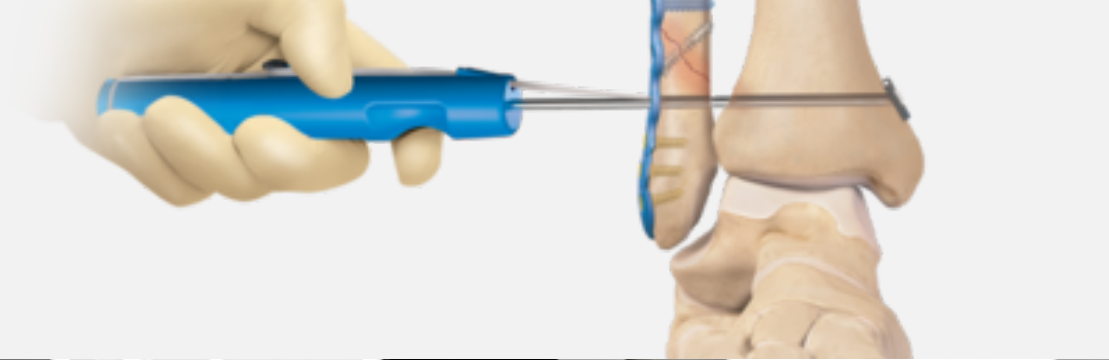
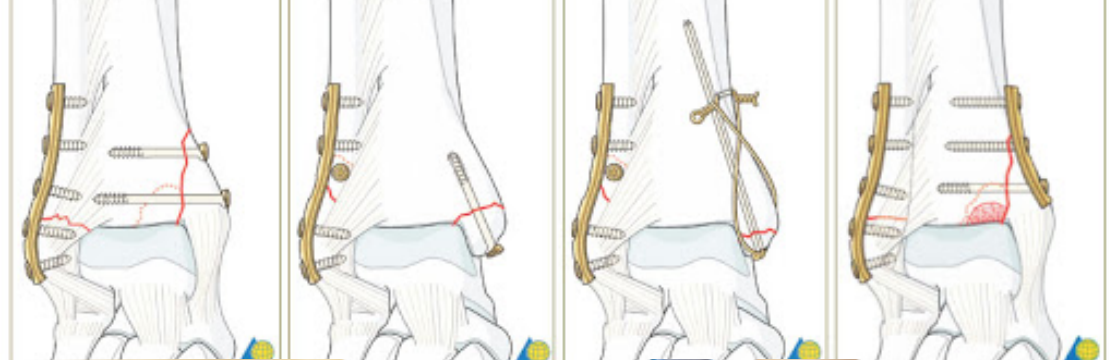
SO ISOLATED, UNDISPLACED
LATERAL OR MEDIAL MALL
FRACTURE DON'T NEED
FIXING... THEY ARE STABLE



BUT WHAT IF FIBULAR
FRACTURE AND DELTOID
INJURY??

- IF
EQUIVOCAL,
EG
BRUISING
MEDIALY,
NO
WIDENING,
SUGGEST
WB XRAY AT
1 WEEK





SURGERY

FIBULA

MEDIAL MALL

SYND

POSTERIOR MALL

REHAB

NON OP

- WB CAST OR BOOT 6 WEEKS. EARLY ROM

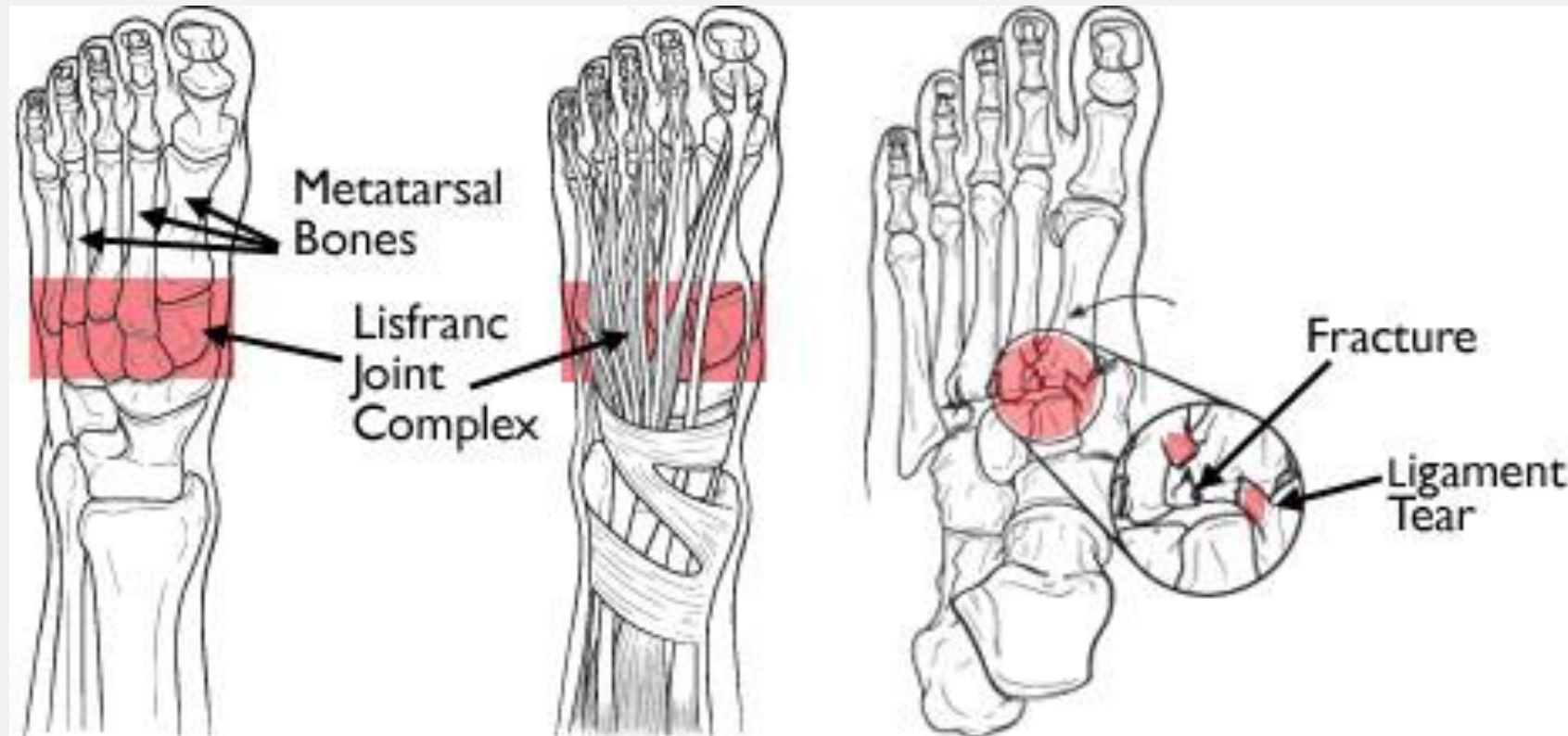
OP

- PLASTER 2 WEEKS
- COMMENCE ROM AT 2 WEEKS
- EITHER PWB OR FWB IN BOOT AT 2-6 WEEKS.
 - IMPROVED ROM. BUT INCREASED INFECTION IN CIOCHRANE 2008
- DM X 2
- SWIMMING BEFORE 3 MONTHS
- RUNNING AFTER 4-6 MONTHS.
- FULL RECOVERY 1 YEAR,

LISFRANC INJURIES

LISFRANC INJURY

- an injury in which one or more of the metatarsals are displaced with respect to the tarsus



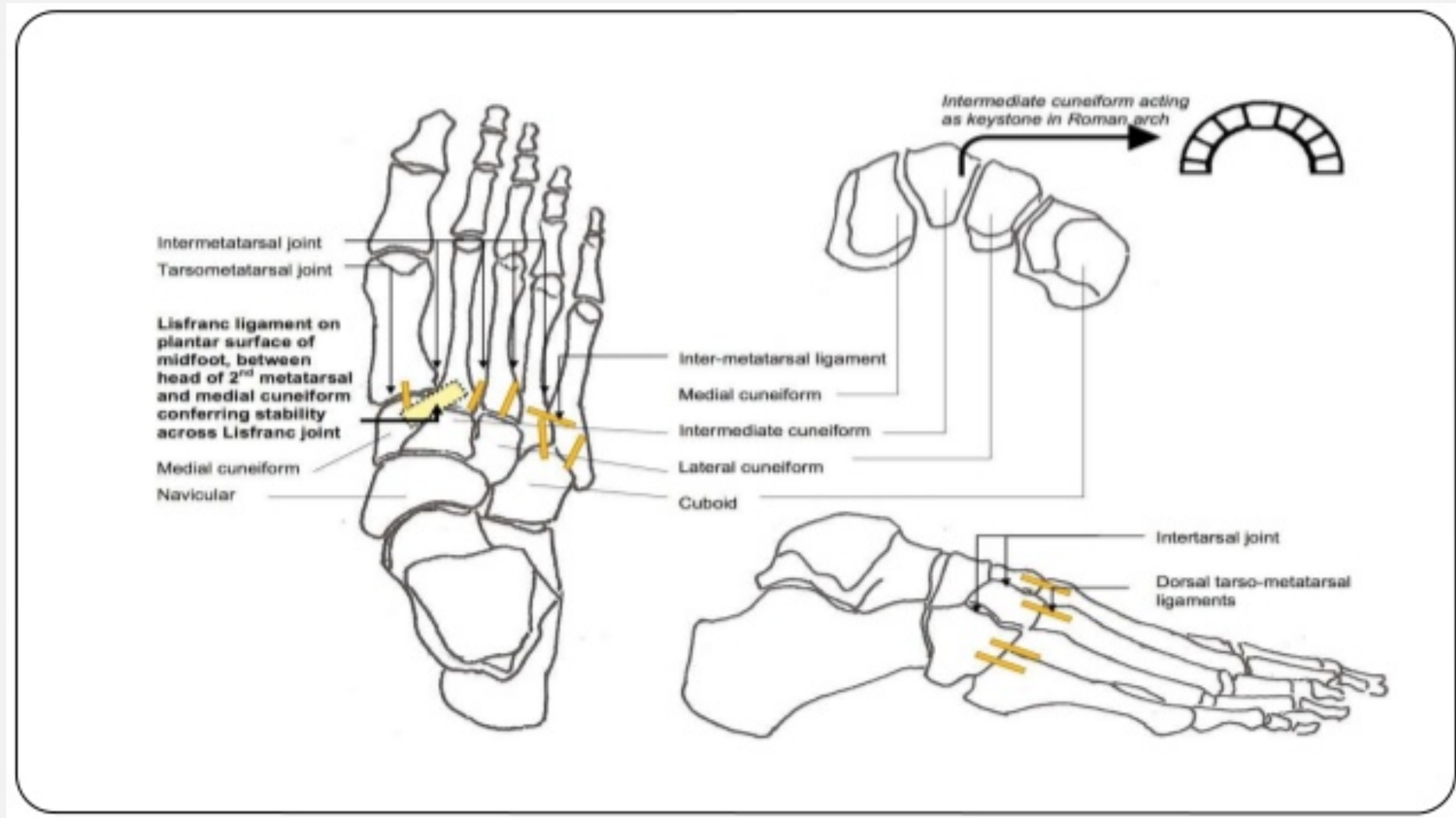
References

Moracia-Ochagavía I, Rodríguez-Merchán EC. Lisfranc fracture-dislocations: Current management. EFORT Open Rev. 2019;4(7):430–44

ANATOMY

- Lisfranc joint - aka tarsometatarsal joint (TMTJ)
 - formed by articulation of 5 MTs with 3 cuneiform bones and the cuboid
 - 1st-3rd cuneiform articulations w/ MTs are highly stable w/ little/no mobility
 - 4th-5th MT joint w/ cuboid has greater mobility, allowing foot to adapt to uneven ground

BONY ANATOMY - KEYSTONE IN ROMAN ARCH



LIGAMENTOUS ANATOMY

- Dorsal and plantar ligaments
 - dorsal ligaments usually weaker, hence displacement usually dorsal
- Inter-metatarsal ligaments
 - join 2nd - 5th MTs
- Lisfranc ligament complex
 - Lisfranc ligament from medial cuneiform to base 2nd MT
 - TMT ligaments and lisfranc ligament

EPIDEMIOLOGY

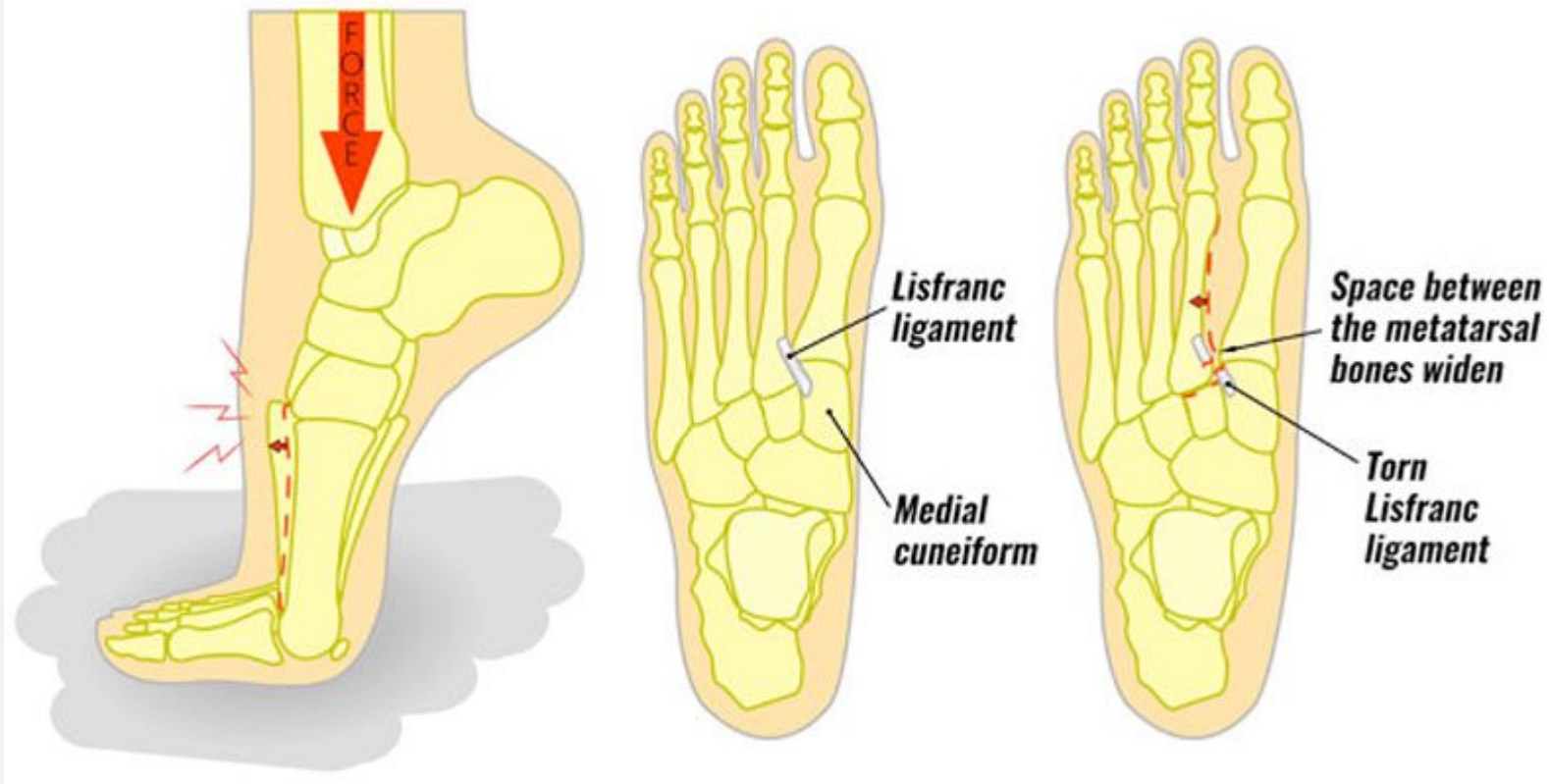
- 2-4x more common in men
- common 20-30 yr olds

MECHANISM OF INJURY

- Axial load w/ foot in plantar flexion
- RTAs
- fall from height
- sporting injuries
 - basketball, rugby, football - one player may fall onto another's heel



MECHANISM OF INJURY



TYPES

- Low vs High energy
- Bony vs soft tissue
- Subtle vs Obvious

Up to 20% of injuries missed on initial assessment

**Failure to treat appropriately can lead to progressive deformity,
instability + post-traumatic OA**

SYMPTOMS

- may feel “pop” in midfoot followed by pain on WB
- post-traumatic pain, swelling and difficulty WB
- may start to WB if only subtle injury

SIGNS

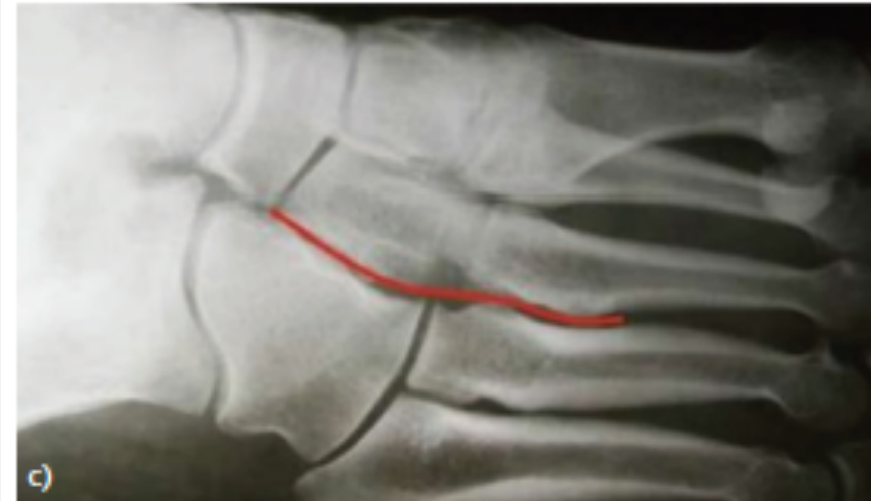
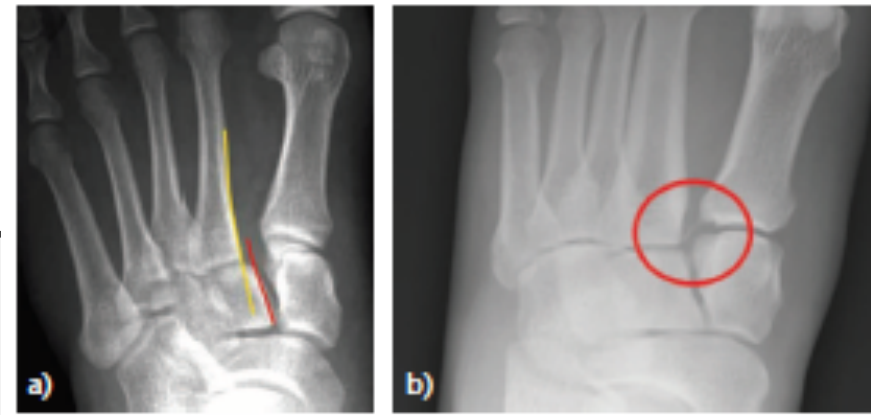
- plantar ecchymosis in midfoot
- pain on palpation of TMTJs
 - passive abduction and/or pronation of forefoot whilst keeping hindfoot fixed
- Piano key test
 - moving head of affected MT whilst stabilising midfoot + hindfoot
- Inc. distance between hallux and 2nd toe
 - inter-cuneiform instability
 - known as “positive gap”



Fig. 7 Plantar ecchymosis is a pathognomonic sign of Lisfranc injury.

INVESTIGATIONS

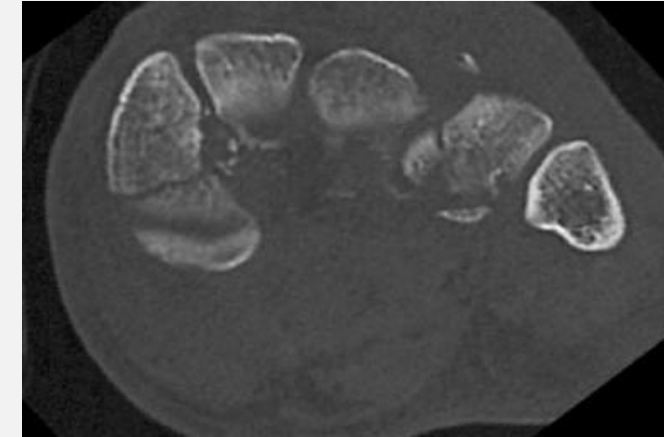
- XR
 - NWB study if severe high energy injury
 - otherwise WB preferred +/- comparative XR of non-affected side
- AP
- oblique
- lateral



INVESTIGATIONS

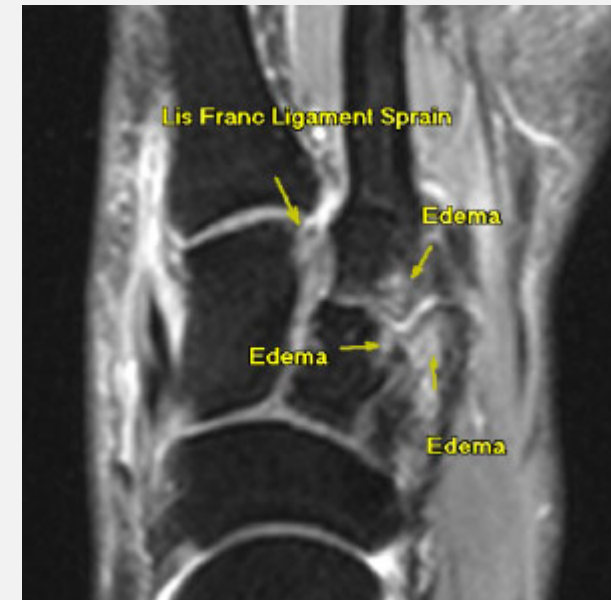
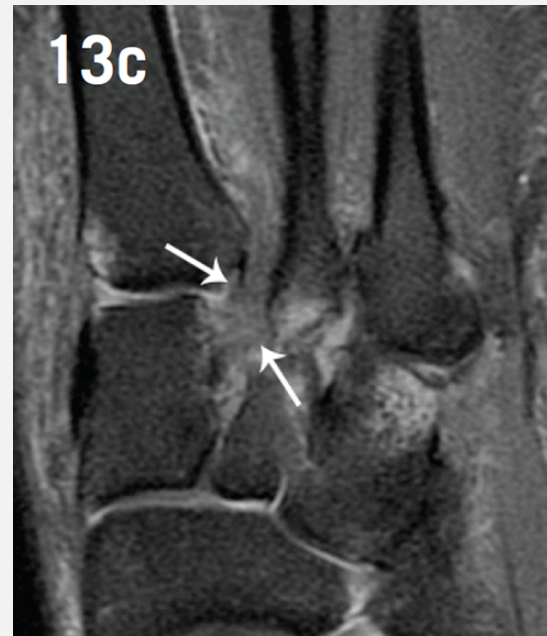
- CT

- useful for subtle fractures and surgical planning



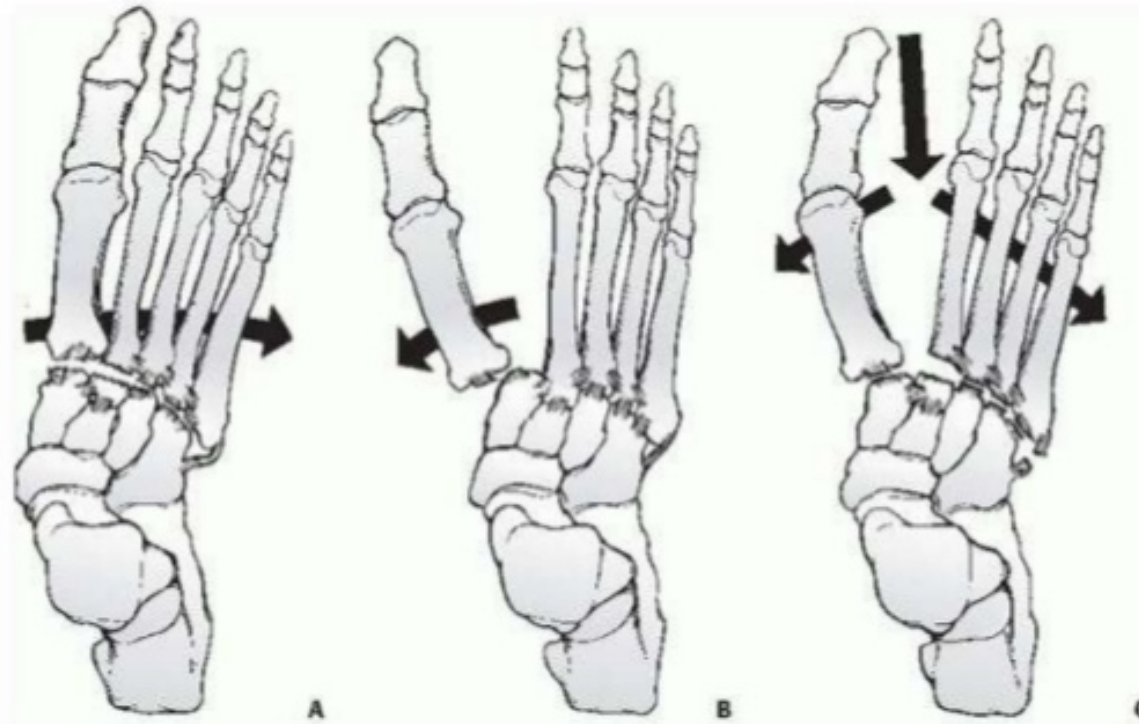
- MRI

- good for soft tissue/ligamentous injuries
- up to 94% sensitive (good for subtle injuries)



CLASSIFICATION

Quenu and Kuss (1909)



Homolateral

Isolated

Divergent

CLASSIFICATION - HARDCASTLE AND MYERSON

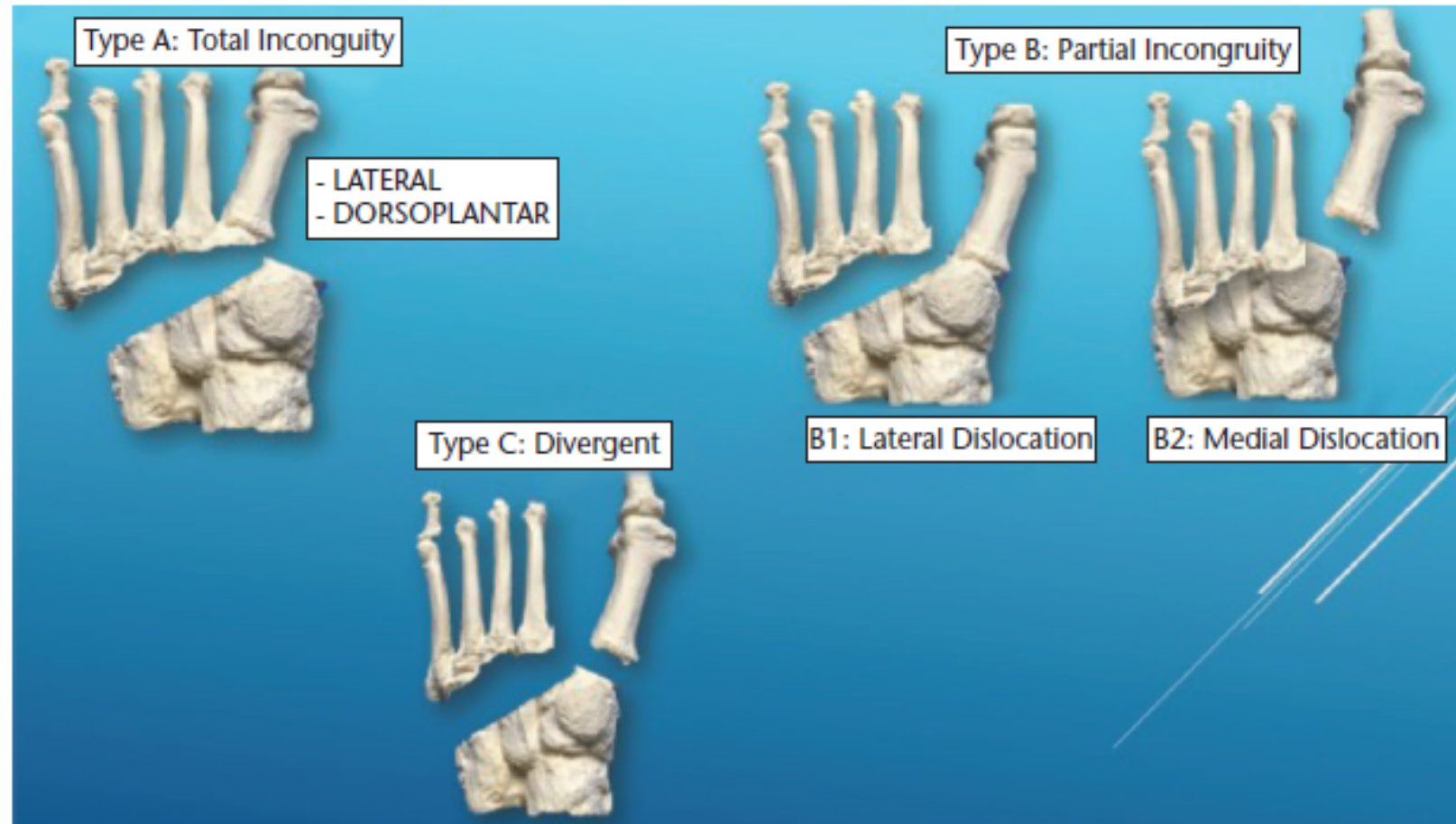


Fig. 6 The 1986 Myerson classification for Lisfranc fracture-dislocations.⁹

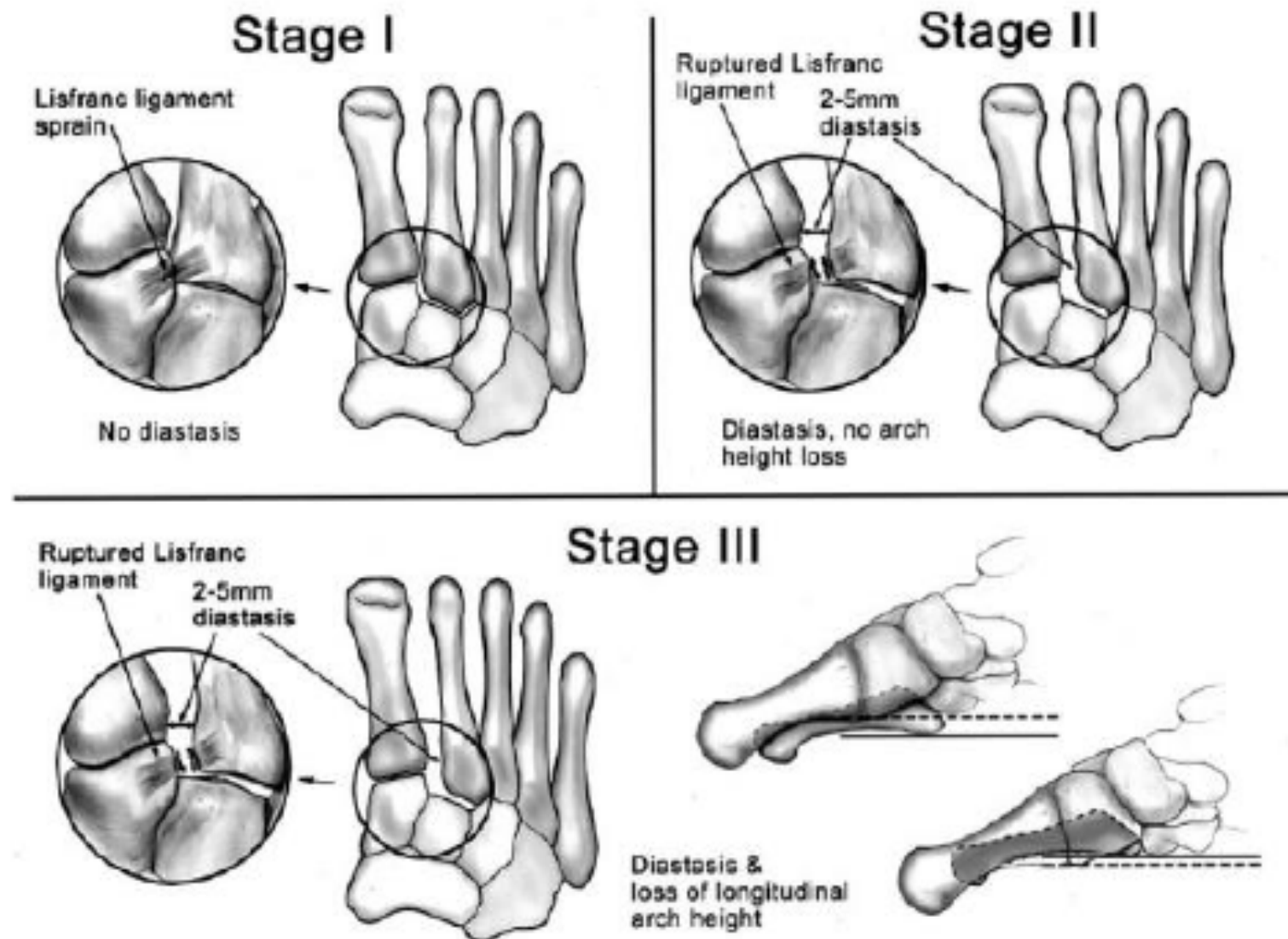


Figure 6 – Nunley & Vertullo Classification of Midfoot Sprains

TREATMENT

- Non-Operative
 - Lisfranc ligament sprains
 - stable, non-displaced lesions (Nunley + Vertullo Stage I)
 - NWB below knee cast for 6/52
 - if continuing pain at 6/52, walking boot FWB for further 4/52
 - if nil pain at 6/52, can gradually return to sports w/ medial arch support insole

TREATMENT

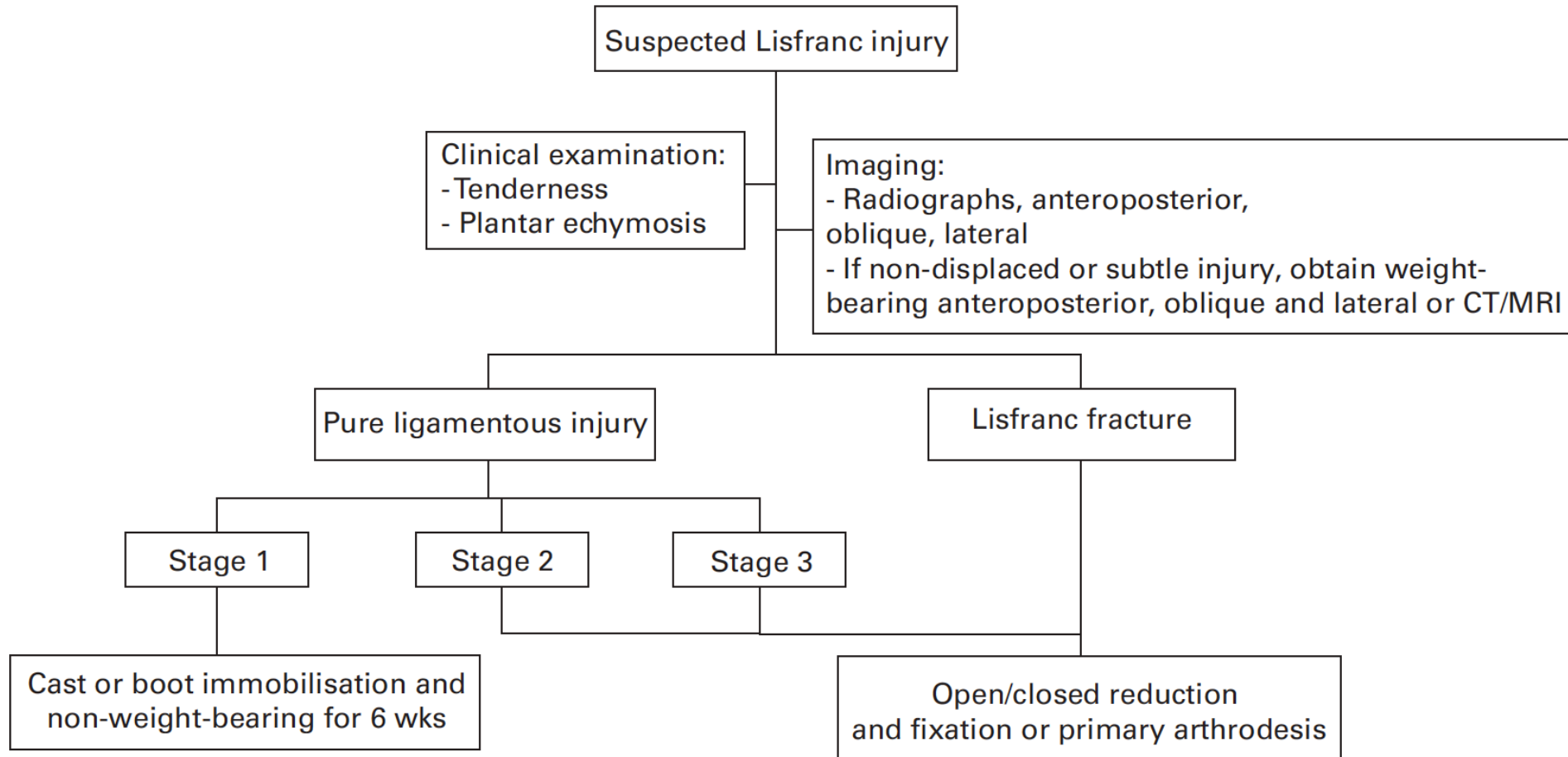
- Operative

- displaced or unstable
Lisfranc joint injuries need
anatomical reduction +
surgical stabilisation

OSTEOSYNTHESIS - SCREWS VS DORSAL BRIDGE PLATES

- Biomechanical study showed cortical screws vs partially threaded cannulated screws showed no difference in strength when PVWB
- Dorsal plates
 - avoids screws crossing joints and damaging articular cartilage
 - biomechanical study - transarticular screws vs dorsal plate
 - similar in resisting TMTJ displacement on simulated WB





REHAB

- UPTO 92% WILL RETURN TO PREINJURY LEVEL OF SPORT 2 YEARS AFTER INJURY - LIGAMENTOUS
- AFTER PRIMARY PARTIAL FUSION
 - 13/37 decreased participation and limitations in physical activity.
 - 97% satisfied
 - 17 elite athletes all returned to sport. Training 18-24 weeks, RTP 21-31 weeks.

ACHILLES TENDON RUPTURE

- Increased incidence
 - More weekend warriors!
- History typical
 - Felt like kicked to back of calf
 - Fell over



ON EXAMINATION
[HTTPS://WWW.YOUTUBE.COM/WATCH?V=8PVGUVUV8N8U](https://www.youtube.com/watch?v=8PVGUVUV8N8U)

Sensitivity of tests for acute achilles tendon rupture

Gap	0.73
Ankle of declination	0.88
Calf squeeze	0.96

Simmonds' triad of tests 100% sensitive

TREATMENT

- Traditionally compare
 - Op (open) vs non-op (plaster, NWB)
 - 5% vs 10%
- Evolved
 - Main change Functional rehab
 - Equivalent rerupture rates
 - MIS (some studies better patient satisfaction, less wound problems, same re rupture)
- Athletes – fix
- Gap size – controversial:
 - 5mm, 10mm, relevance...!

Table I. Management of patients during immobilisation period for operative and non-operative patients

Week	Conservative	Surgical
0 to 2	Equinus FWB cast with a wedge in the best position that opposes the tendon ends	Back slab NWB
2 to 5	Vacoped boot locked at 30 degrees FWB	Vacoped boot locked at 30° FWB
5 to 7	Vacoped boot 30° to 15° FWB Yellow theraband exercises for soleus and gastrocnemius	Vacoped boot 30° to 15° degrees Yellow theraband exercises for soleus and gastrocnemius
7 to 9	Vacoped boot 0-30 degrees with a flat wedge FWB	Vacoped boot 0-30 degrees with a flat wedge FWB
9 to 10	Vacoped boot fully unlocked FWB	Vacoped boot fully unlocked FWB
10 to 16	Removal of boot To wear only in vulnerable environments (6/52)	Removal of boot To wear only in vulnerable environments (6/52)

FWB, Full Weight Bearing, NWB, non weight bearing

Table II. Rehabilitation guidelines after immobilisation for operative and non operative patients)

Do	Do not
Weeks 10 to 12 post injury	
Issue patient with a heel raise for shoe	
Warn the patient that most re-ruptures occurs during this phase	
Advise the patient to avoid activities which involve extreme dorsi flexion of the ankle combined with active plantar flexion	
Advise the patient that they will not return to sports which involve running until they are 6 to 8 months post injury	
Advise the patient on a PWB gait pattern; particularly re-educating the toe off phase of gait	Do NOT attempt running, jumping or hopping
Work on ROM of the ankle and foot. Particularly length of soleus and gastrocnemius	
Lower limb muscle strength work. Particularly of the plantar flexors	Do NOT attempt eccentric lowering exercise off a step used for tendonopathies. Do not attempt resistance plantar flexion exercises which requires more than half the patients body weight
Proprioception exercises	
Gentle plyometric exercises	
Hydrotherapy – particularly good during this phase	
For surgical patients take care of the scar. Any sign of break down refer patient back to clinic as soon as possible	
3 to 5 months post injury	
Dispense of heel raise	
Continue to avoid activities of extreme dorsi flexion combined with active plantar flexion	
Aim to single leg heel raise	
Plyometric – progress for example start with 2 feet jumps (bunny hops), jogging on trampet, PWB jogging, i.e., leaning on table	
5 to 6 months post injury	
Gait – Start jogging on the flat	
Strength – start eccentric exercises off step	
Progress proprioceptive exercises as appropriate	
Sports specific rehab exercises	
6 to 8 months post injury	
Gait – introduce hill running	
	Return the patient to competitive sports until they can: single leg heel raise; sprint with the toe off phase of gait; until horizontal single leg hop x 3 is at least 75% of good leg and vertical hop is at least 75% of good leg
Introduce hopping and progress to long horizontal and vertical hops	
Return to sport as able	
ROM, range of movement	

LATERAL LIGAMENT INJURY

- MRI STUDY
 - 75% ISOLATED ATFL, 20% ATFL+ CFL, 5% PTFL
- O/E
 - TENDERNESS OVER ATFL AT 5 DAYS POST INJURY
 - ANT DRAWER
- IX
 - STRESS RADIOGRAPHY ACCURACY – 67%
 - USS – 91%
 - MRI – 97%

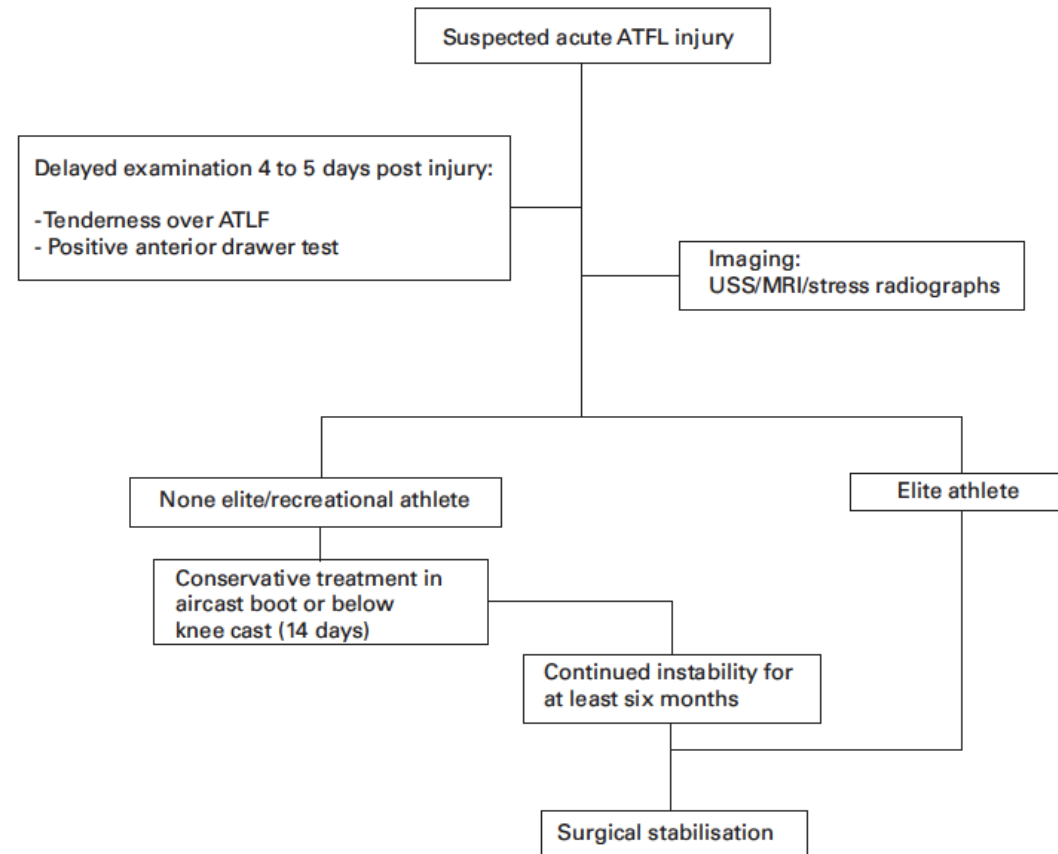


Fig. 2

Treatment algorithm for suspected injury of the anterior talofibular ligament (ATFL). (USS, ultrasound scan).

- **NON OP**

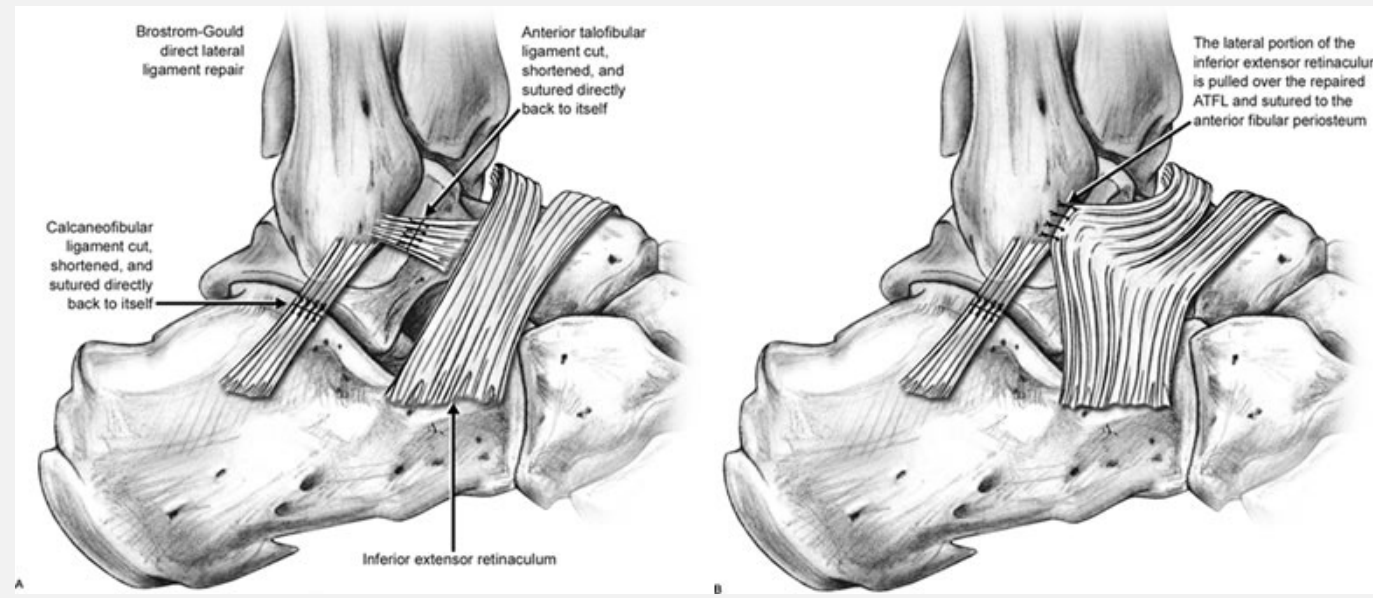
- AIRCAST BRACE OR BOOT BETTER THAN TUBIGRIP
- FUNCTIONAL REHAB AFTER SHORT PERIOD IMMOBILISATION > 6 WEEKS IMMOBILISED.

- **OP**

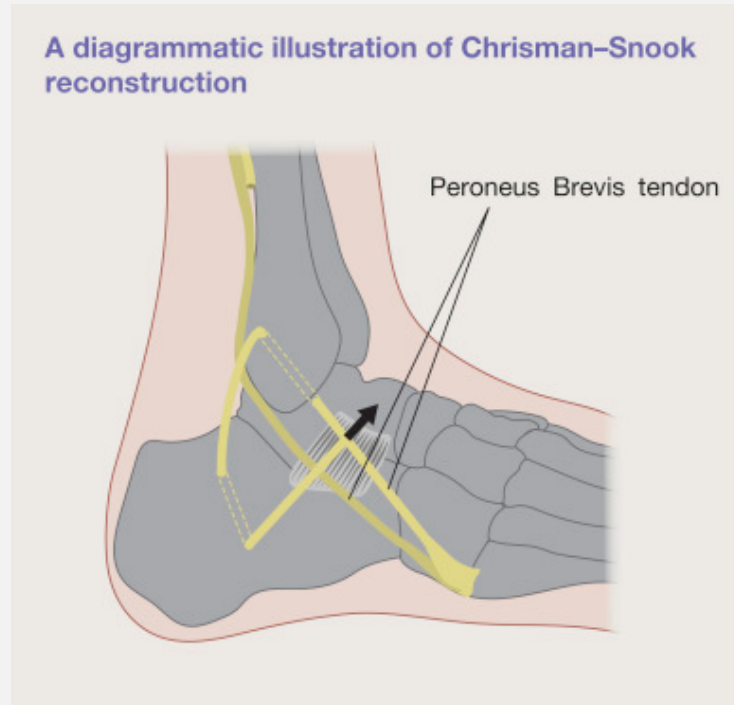
- RETURN TO SPORT 94-100%
- EARLY MOBILISATION FOLLOWED BY CRITERIA BASED MILESTONES.

Procedure: Brostrom Ligament Repair Ankle
Chrisman-Snook Ankle Stabilisation

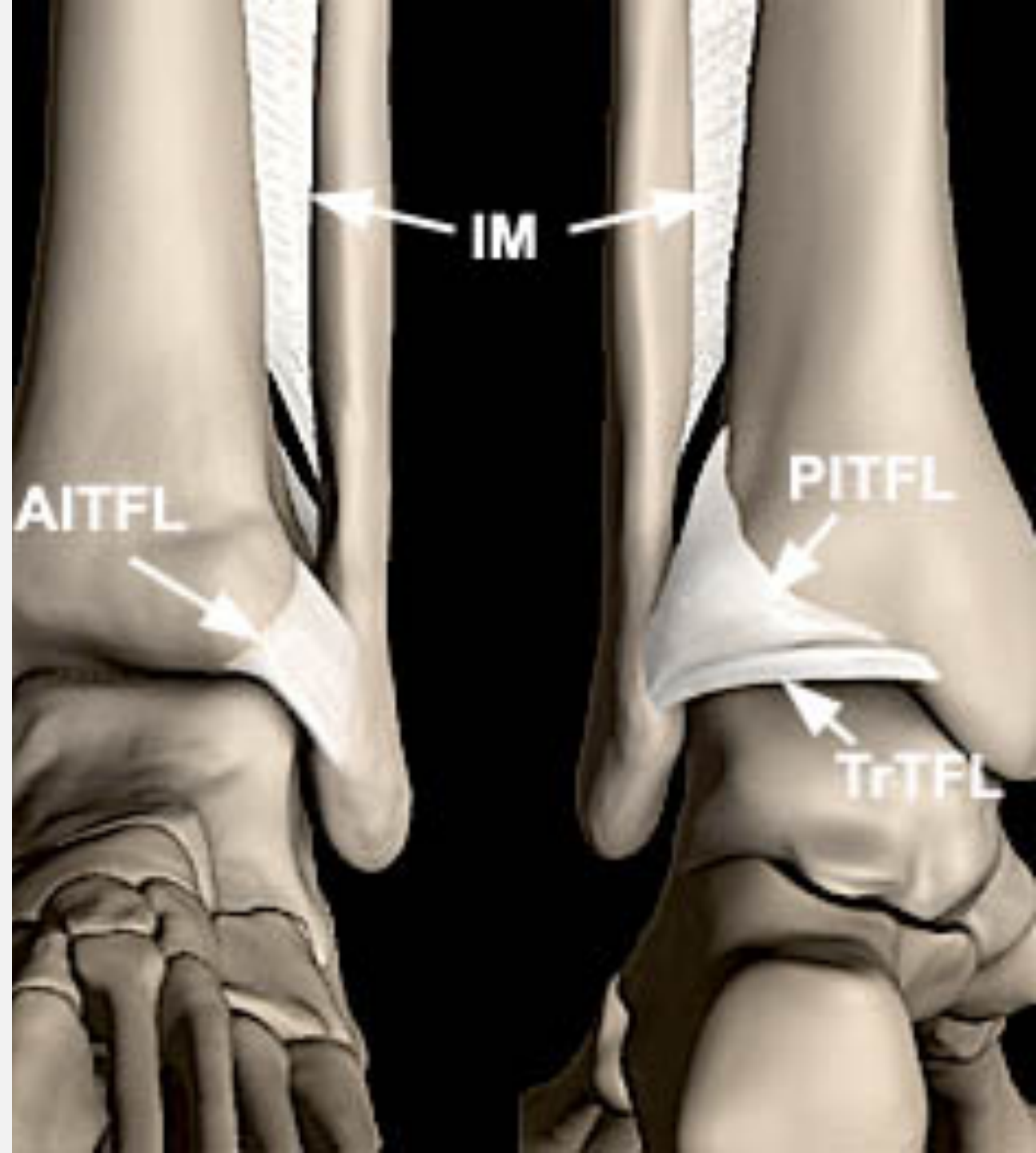
		clinic	<u>2</u>	<u>4</u>	<u>12</u>	<u>26</u>
Full pop theatre neutral <u>dorsiflexion</u> max eversion						
Mobilise FWB						
Ted stocking opp leg						
Elevate 2 weeks						
Anti <u>coag</u> 6/52						
OPD 2wks CNS	P	-wound check / ROS				
		-POP FWB				
OPD 4 <u>wks</u> CNS	P	POP off, apply ankle brace, PT-ROM, <u>peroneals</u>				
OPD 12 <u>wks</u> REG		Brace off				
OPD 26 <u>wks</u> REG		Discharge if all well / <u>continue</u> POD				



- ANATOMICAL – BROSTRUM GOULD
 - +/- ANCHORS, INTERNAL BRACE
- NON ANATOMICAL – EVANS, CHRISMAN SNOOK
 - STIFFNESS



SYNDESMOTIC INJURY



MOI

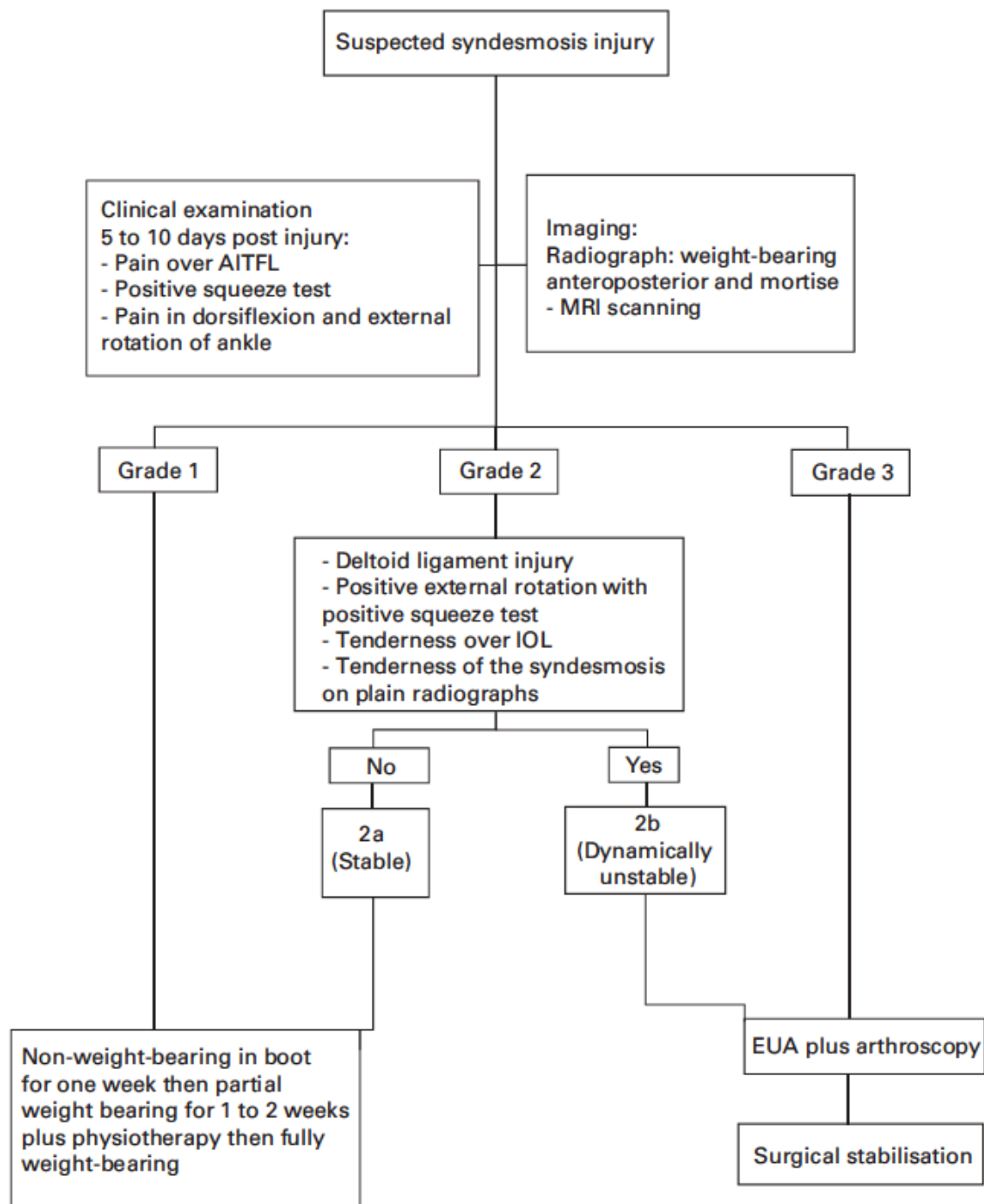
- ER TALUS ON PLANTED FOOT

O/E

- HIGH ANKLE PAIN
- DF/ER TEST SENSITIVITY 92%

WEST POINT GRADING SYSTEM

- **1. SPRAIN AITFL. NO INSTAB**
- **2. TEAR AITFL, INCOMPLETE IOL – slight instab**
- **3. COMPLETE OF ALL AND GROSS INSTAB**



POST OP

- NWB CAST/BOOT 14 DAYS
- PWB BOOT WEEKS 2-3
- FWB BOOT WEEKS 3-5
- ROM/PROPRIOCEPTION AT 2 WEEKS.
- RTS 8 WEEKS

BASE 5TH MT FRACTURE



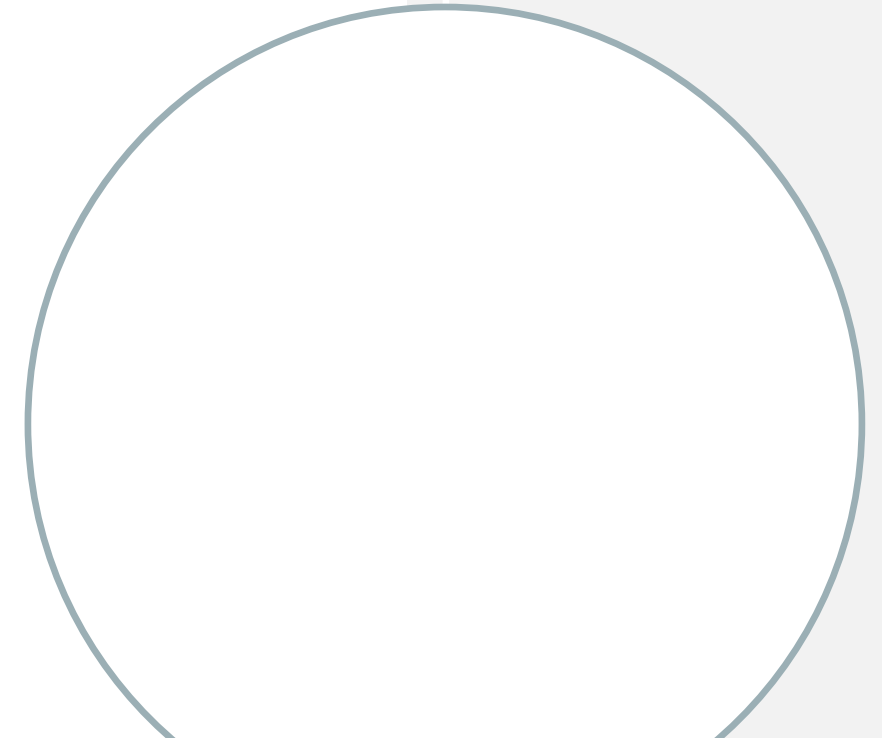
- MOST PROXIMAL 1.5CM
- 70% MT FRACTURES INVOLVE 5TH
 - 80% PROXIMAL
- COMMON IN SPORTS
- INVERSION
- TENDERNESS
- TUB... EXTRAARTIC.
 - CONSERVATIVE. EARLY WB IMPORTANT
 - OP LARGE FRAGMENT, DISPLACED >2MM, >30% JOINT. SCREW.

- **TYPE2 :**

- JONES. DOES INVOLVE 4/5 JUNCTION.
- 21 WEEKS AVERAGE HEALING (5 MONTHS). NWB CAST INITIALLY PROGRESS TO WB.
- FIX ALL ATHLETES. FIX INFORMED PATIENT WHO WANTS TO HEAL QUICKER AND LOWER RATE OF NONUNION, BUT HIGHER RISK OF COMPLICATION. Studies show higher rate of union (94.7vs 72.2%, and quicker return to sport 8 weeks vs 15 weeks).
- FIX WHEN SIGNS OF DELAYED UNION.

- **TYPE 3:**

- DISTAL TO 4/5 JUNCTION.
- SUBCLASSIFIED BY TORG ACCORDING TO SCLEROSIS.
- LOW DEMAND NON OP. MORE ACTIVE USUALLY FIX.
- 1 AND 2 CAN BE MANAGED NONOP WITH NWB CAST. I TAKE AROUND 10 WEEKS TO HEAL. TORG 2 AROUND 20 WEEKS
- 3 NEED FIXATION..



Type	Time after fracture	Characteristics
1	Accute	Thin fracture line Without intramedullary sclerosis
2	Delayed union	Widening of fracture line Intramedullary sclerosis
3	Non union	Eradication of intramedullary canal

Table 1: Torg classification based on fracture time [23].



Spire

Bushey Hospital

The Wellington Hospital

part of **HCA** Healthcare UK



**Royal National
Orthopaedic Hospital**

NHS Trust

THANK YOU

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