CENTRAL CHAPTER
JAMAICA ASSOCIATION
OF
SPORTS MEDICINE

"MOMMY, my feet hurt…."
Foot disorders affecting the skeletally immature athlete

DR. SAFIYA FRANKLIN
M.B.,B.S.; DM(ORTHOPAEDICS)

Jamaica Association of Sports Medicine Conference
September 9, 2017

DISCLOSURES/AFFILIATIONS

- No financial disclosures related to this presentation
- Affiliations
  - ACSM/AOSSM Certified Team Physician
  - FIFA certified Football Medicine Instructor
  - Member Jamaica Association of Sports Medicine – Central Chapter
  - International Member of American Academy of Orthopaedic Surgeons
  - Member of Caribbean Association of Orthopaedic Surgeons
  - Member of Jamaican Orthopaedic Association
  - Team Physician Multiple National Sport Teams since 2004

FOOT DISORDERS IN SKELETALLY IMMATURE ATHLETES

- Foot and ankle complaints are the SECOND most frequent reason for visit to the doctor [1]
- Almost all foot and ankle injuries in children related to sports [2]
- A careful history, focused physical examination, understanding of foot and ankle biomechanics
- Understanding of the sport involved and likely mechanism of injury

FOOT DISORDERS IN SKELETALLY IMMATURE ATHLETES "WHY?"

- Congenital abnormalities problematic in child athlete
- Changes in muscles and bones of the foot with growth
- Anatomy of the paediatric foot and its variants
- Physes in long bones and cartilage in small bones make them prone to repetitive stress and acute injuries
- Intense physical activity leading to overuse injury

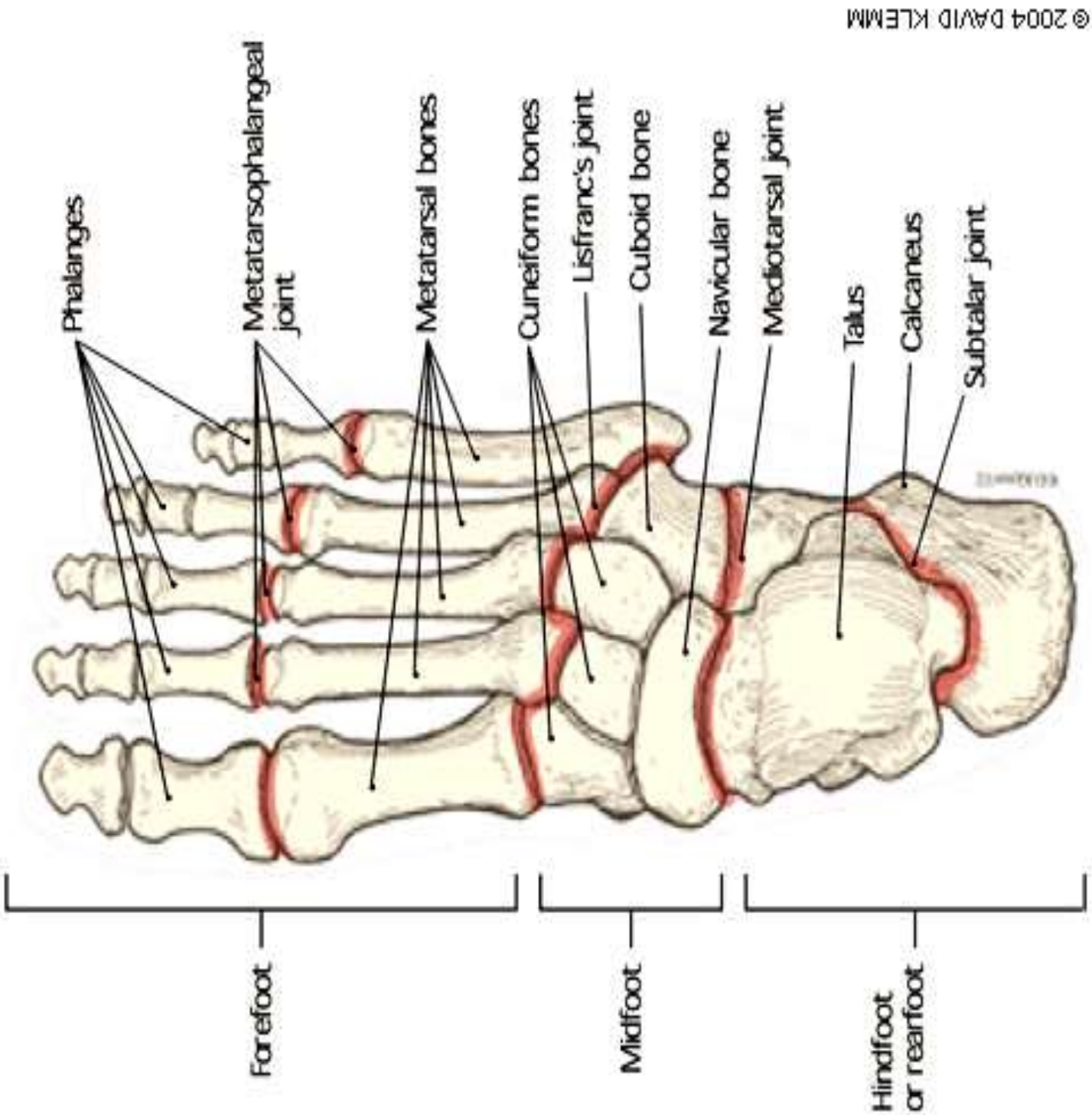
FOOT DISORDERS IN SKELETALLY IMMATURE ATHLETES

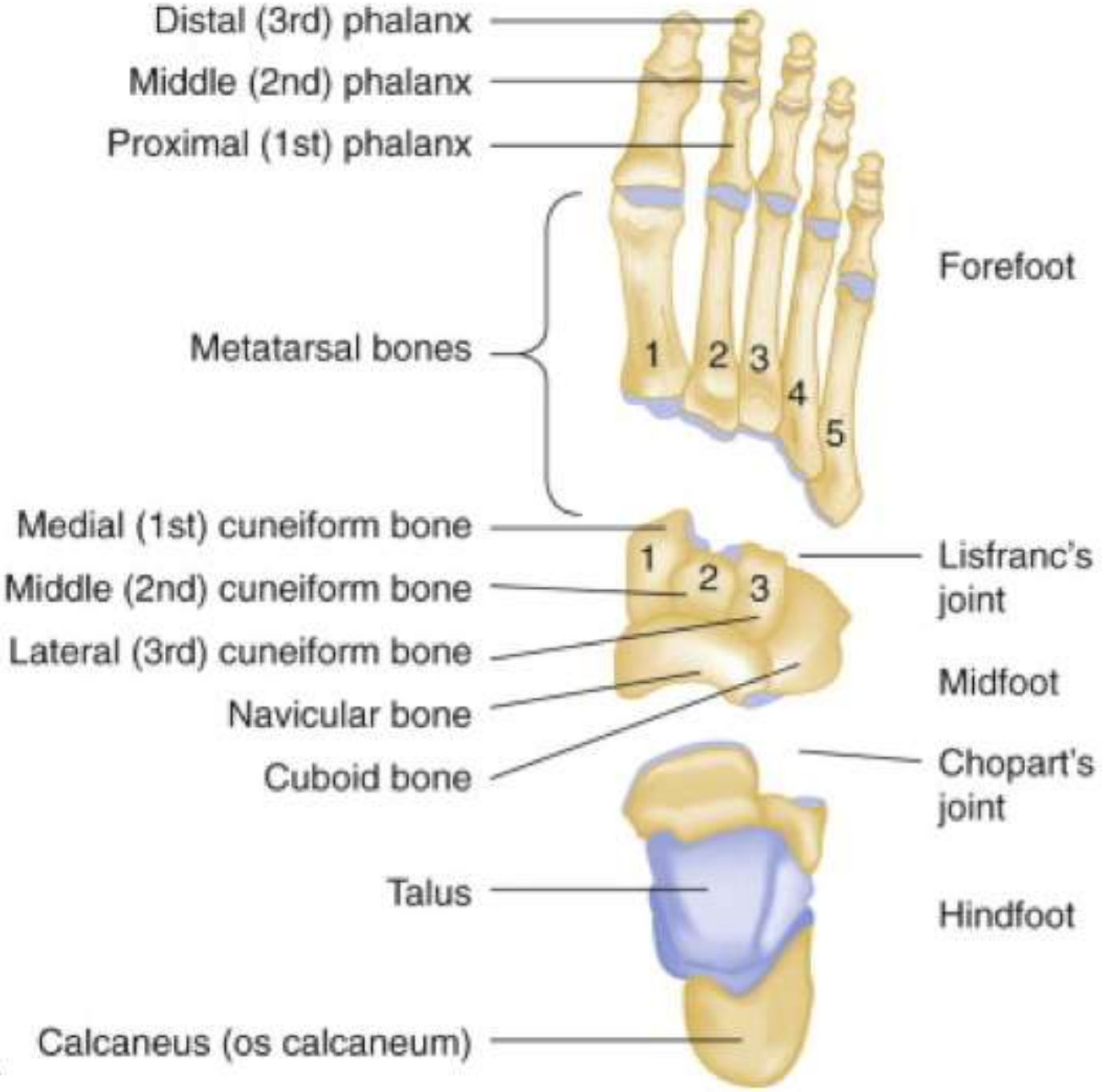
- Congenital problems
- Developmental problems
- Growth related
- Overuse related
- Acute injuries
- Idiopathic

FOOT DISORDERS IN SKELETALLY IMMATURE ATHLETES

	HINDFOOT	MIDFOOT	FOREFOOT
GROWTH & DEVELOPMENTAL CONDITIONS	1. Talocalcaneal coalition 2. Pes Planus	1. Calcaneonavicular coalition 2. Accessory Navicular	1. Juvenile Bunion
OVERUSE	1. Sever's Disease 2. Plantar Fasciitis 3. Calcaneal Stress Fracture	1. Navicular stress fracture 2. Kohler's disease	1. Metatarsal stress fracture 2. Iselin's disease 3. Freiberg's infraction 4. Sesamoid pathology
ACUTE	1. Calcaneal fractures	1. Lisfranc injury	1. 5th Metatarsal Avulsion Fracture 2. Jones fracture 3. Turf Toe 4. Sesamoid Pathology

ANATOMY
FOOT




Distal (3rd) phalanx
Middle (2nd) phalanx
Proximal (1st) phalanx
Metatarsal bones
1
2
3
4
5
Forefoot
Medial (1st) cuneiform bone
Middle (2nd) cuneiform bone
Lateral (3rd) cuneiform bone
Navicular bone
Cuboid bone
1
2
3
Lisfranc's joint
Midfoot
Chopart's joint
Talus
Hindfoot
Calcaneus (os calcaneum)

HIND FOOT

TARSAL COALITION

- Fusion of 2 or more tarsal bones
- Bony or fibrocartilaginous bridge
- 1-3% incidence
- Common coalitions (90% cases):
  Calcaneonavicular (CN)
  Talocalcaneal (TC)
- Less common: calcaneocuboid, talonavicular, calcaneonavicular
- Bilateral 50%
- More than 1 coalition in same foot

TARSAL COALITION
CLINICAL ASSESSMENT

HISTORY

- Asymptomatic until older/ early adolescence
- Recurrent ankle sprain
- Recurrent distal fibular physeal fracture
- Pain with sport relieved with rest
- Laterally (sinus tarsi)
- Medially

EXAMINATION

- Tenderness laterally or medially
- Rigid flatfoot
- Decreased subtalar motion
- Subtalar joint clicking
- No heel varus on tiptoe
- Peroneal tightness
- Pain with foot inversion

TARSAL COALITION IMAGING

- Plain radiographs

  AP/Lateral/Oblique views:

  calcaneonavicular

  Harris Axial view:

  talocalcaneal
- CT Scan is gold standard for diagnosis
- MRI Scan to diagnose fibrous coalition

CALCANEOVANICULAR BAR

TALOCALCANEAL COALITION

TALONAVICULAR COALITION

TARSAL COALITION TREATMENT

CONSERVATIVE

Targets pain control

Talocalcaneal coalition responds best

- Activity modification
- Orthotics / Short leg walking cast
- Stretching/Strengthening/Proprioception
- Non-steroidal Anti-inflammatory drugs

SURGERY

TARSAL COALITION SURGERY

FAVOURABLE

Age <18 years

Calcaneonavicular coalitions

Non-bony coalitions

CONTRAINDICATIONS

Massive calcaneal coalitions

Degenerative arthritis

Age > 16 years (relative)

- Excision
- Calcaneal osteotomy
- Arthrodesis of involved joints
- Return to sports ~ 2-3 months

CALCANEAL APOPHYSITIS (SEVER'S DISEASE)

- Frequent cause of heel pain
- Worst with activity
- No night pain
- M > F
- Age: 8-12 years old
- 8% of all overuse injuries
- Bilateral 60%
- Sports: Tennis, Badminton, Track & Field

CALCANEAL APOPHYSITIS (SEVER'S DISEASE)

- Localised tenderness posterior heel at TA insertion
- No acute inflammatory signs
- Mild Achilles contracture
- Weak ankle dorsiflexors

CALCANEAL APOPHYSITIS (SEVER'S DISEASE) IMAGING

- Normal
- **Plain X-rays**

  Fragmentation

  Sclerosis of calcaneal apophysis
- **Bone Scan** or **MRI** if diagnostic uncertainty

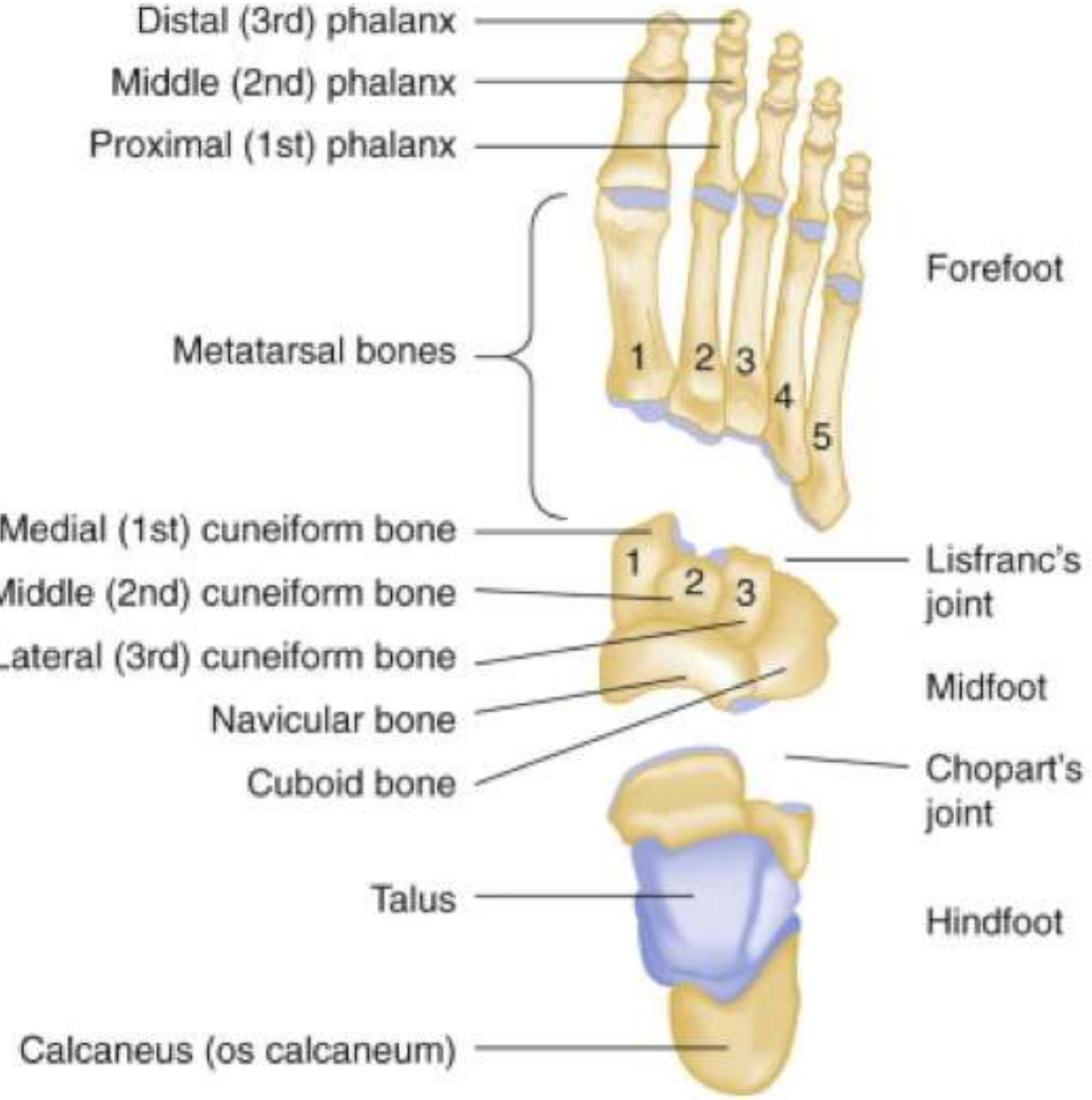
CALCANEAL APOPHYSITIS (SEVER'S DISEASE) TREATMENT

CONSERVATIVE

- Relative rest
- ICE
- NSAIDS
- Gastroc-soleus Stretching
- Ankle Dorsiflexor Strengthening
- Orthotics

PLANTAR FASCIITIS

- Not common in skeletally immature athletes
- Overuse from athletic activity
- Activity: Speedwork, jumping, hill running, dancers
- History: medial arch or heel pain
- P/E: tenderness anteromedial calcaneus
- Radiographs: not diagnostic
- Treatment: Conservative
- Best results within 1st 6 weeks of symptoms
- Rest, ICE, NSAIDS, Rehabilitation, Orthosis
- No studies in adolescents of steroid injections
- Extracorporeal shock-wave therapy mixed results
- RARELY surgery


Distal (3rd) phalanx
Middle (2nd) phalanx
Proximal (1st) phalanx
Metatarsal bones
1
2
3
4
5
Forefoot
Medial (1st) cuneiform bone
Middle (2nd) cuneiform bone
Lateral (3rd) cuneiform bone
Navicular bone
Cuboid bone
1
2
3
Lisfranc's joint
Midfoot
Chopart's joint
Talus
Hindfoot
Calcaneus (os calcaneum)

MIDFOOT

FLAT FOOT

- Normal foot position up to Age 6
- Most are asymptomatic
- Flexible versus Rigid
- Association with accessory navicular
- Most do not require treatment
- Painful flat foot –
  semirigid orthotic
  running shoes to support the arch
- Rarely surgery in this population

ACCESSORY NAVICULAR

- Most common accessory bone in the foot
- 4-14% population
- Separate extrachondral ossification centre
- Located at site of Tibialis posterior insertion
- Hx: pain along medial arch of foot especially with shoewear
- P/E: tender prominence medial arch
  callus over prominence
  flat foot
- Radiographs: AP/Lateral/ OBLIQUE view of foot
- Treatment: Conservative
  orthotics, donut cut-outs for prominence
- Surgery: recalcitrant cases

ACCESSORY NAVICULAR

LISFRANC JOINT SPRAIN

- Not a common injury
- Seen in rugby players, football players
- Often times missed 20%
- Mechanism: axial loading in a forcefully plantar flexed rotated foot
- Hx: dorsal foot swelling, midfoot pain and NWB
- P/E: Ecchymoses plantar foot, tender midfoot
- Xrays: WB AP/Lateral/Oblique foot plus comparison views
- Treatment based on severity

Cast immobilisation or walking boot 4-6/52

Surgery in more severe cases

LISFRANC JOINT SPRAIN

STRESS FRACTURES

- Insufficiency / Fatigue fractures
- 15% all athletic injuries
- Overuse injury. Healthy bone unable to withstand chronic repetitive submaximal loads
- Running, jumping, intense walking events, amenorrhea
- Foot stress fractures (metatarsal and navicular) less common than adults
- Other possible sites: Calcaneus, Cuboid and sesamoids

STRESS FRACTURES

- Gradual onset
- Worsening pain
- Aggravating factors: activity
- Relieving factors: Rest
- Most occur in first 3-7 weeks after starting activity
- Pain localised to involved bone
- Combination of risk factors contribute

STRESS FRACTURES
IMAGING

- Plain Xrays
- NB: typical changes can be delayed 2-12 weeks
- 50% stress fractures not apparent on plain Xrays
- Xray findings

  - cortical bone: periosteal reaction or callous formation or fracture line

  - cancellous bone: sclerosis

METATARSAL STRESS FRACTURE

STRESS FRACTURES

- Diagnose clinically:

  Risk factors, compatible history and physical findings.
- However, middle of season, Xrays can be normal (delayed 2-12 weeks), with 50% stress fractures not apparent on plain Xrays
- Bone scan or MRI. Highly sensitive.

STRESS FRACTURES TREATMENT

- Relative rest 2-4/52
- Non-land training to maintain physical fitness
- Prevention: reduce risk factors, shock absorbing insole / orthotic
- Pain at rest = Non weight bearing cast for 6- 8 weeks
- Surgery:
  - Non-union metatarsal stress fractures after 6-8/52 non weight bearing
  - Avascular necrosis (sesamoid)
- RTP ~ 4-6 months

KOHLER DISEASE (NAVICULAR OSTEOCHONDROSES)

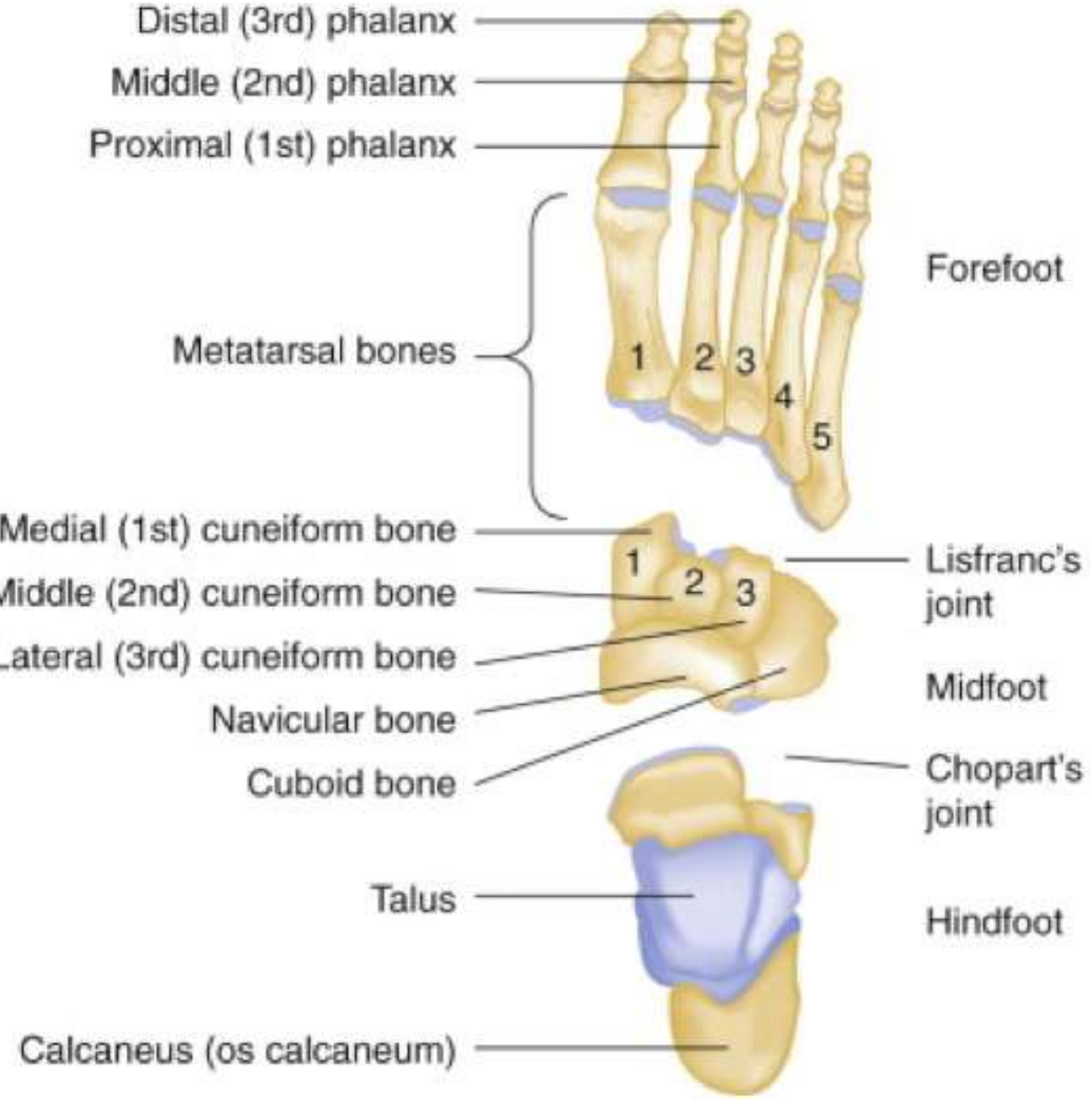
- Self-limiting osteochondroses
- Age: 5-9
- Bilateral 25%
- Hx: gradual onset of pain with no prior trauma; WB worse
- P/E: swelling, tenderness over dorsomedial midfoot; antalgic gait with foot in supination
- Xrays: flattening, sclerosis and irregular rarefraction of navicular
- Treatment: conservative measures (RICE, NSAIDs, activity)
- Recovery accelerated by immobilisation with short leg walking cast x 4-6/52
- Differential diagnosis: navicular stress fracture

KOHLER DISEASE

TRACTION APOPHYSITIS 5TH METATARSAL (ISELIN'S DISEASE)

- Traction apophysitis of base of 5th Metatarsal
- Apophyses appears F= Age 10; M= Age 12
- Fuses 2 years after
- Hx: Pain to lateral aspect of foot; Increase with activity
- P/E: swelling to tuberosity,tenderness on palpation, resisted eversion extreme dorsiflexion and plantar flexion increases pain

5TH METATARSAL APOPHYSITIS (ISELIN'S DISEASE)


Distal (3rd) phalanx
Middle (2nd) phalanx
Proximal (1st) phalanx
Forefoot
Metatarsal bones
1
2
3
4
5
Medial (1st) cuneiform bone
Middle (2nd) cuneiform bone
Lateral (3rd) cuneiform bone
1
2
3
Lisfranc's joint
Midfoot
Navicular bone
Cuboid bone
Chopart's joint
Talus
Hindfoot
Calcaneus (os calcaneum)

FOREFOOT

BUNIONS (JUVENILE/ADOLESCENT)

- Adolescent hallux valgus common
- Incidence 35% general population
- Usually present in flatfeet
- Common in girls
- Gymnastics, Dancing
- P/E: unlike adults
- Treatment: symptomatic
- Changing of shoes
- Altering of sports
- Toe spreading orthotics
- Surgery associated with a high incidence of recurrence

TURF TOE

- Hyperextension sprain of 1st MTPJ
- Mechanism: forced hyperextension of 1st MTPJ
  subluxation and plantar capsule damage
- Predisposing factors: Artificial surface football, hockey
  Highly flexible footwear
  ↑ ankle dorsiflexion
- Can be a chronic painful problem
- P/E: swelling, plantar ecchymosis, limited ROM, antalgic gait
- Imaging : Xrays
  Bone Scan
  MRI
- Treatment: individualised based on severity

TURF TOE
TREATMENT

INDIVIDUALISED

- MILD: Ice, NSAIDS, splint, Activity modification

- MODERATE: As for mild
  Partial immobilisation
  Early ROM and strengthening symptom permitting
- SEVERE: Immobilisation
  Reduced weight bearing
- Long term: shoe modification with stiff forefoot insole

SESAMOID PATHOLOGY

- Stabilises 1st MTPJ
- Conditions : Inflammation
  Fracture/ Sprain (bipartite 5-30%)
  Avascular necrosis
- Repetitive push off ball of feet eg jumping sports and ballet
- Hx: forefoot WB pain; acquired supination foot
- P/E: localised tenderness, swelling
- Ix: AP/sesamoid views; bone/CT if doubtful
- Treatment: RICE, NSAIDS, activity modification, shoe modification, orthoses, physiotherapy

BIPARTITE SESAMOID

FREIBERG'S INFRACTION

- Osteochondroses of 2nd Metatarsal head
- Etiology: repetitive microtrauma vs Avascular
- Adolescent female
- Hx: Forefoot pain worsen with WB and activity
- P/E: focal tenderness over 2nd or 3rd metatarsal head
- Xrays: initial stage widening of MTPJ followed by collapse and sclerosis of metatarsal head
- Treatment:

Avoid forefoot loading activities

Orthosis to offload forefoot until healed

Metatarsal head reossifies in 2-3 years

Cast immobilisation x 6-12/52 in acute stages of severe cases

Surgery to decrease pain in severe cases / failed conservative therapy

FRIEBERG'S INFRACTION

DO NOT FORGET

- Acute Physeal Fractures
- Tendonitis
- Plantar Warts
- Inflammatory Disorders
- Pain Amplification syndromes
- Osteomyelitis
- Tumours: Ganglion
  Osteoid osteoma
  Sarcoma
  Leukemia
  PVNS
  Haemangiomas

RETURN TO SPORT

POSNA/AAOS/AOSSM Position Statement:

A player's injury must be completely healed before return to sports activity

- Free of Pain
- No swelling
- Full Range of Motion
- Normal Strength
- SUPERVISED

SUMMARY

- Foot and ankle injuries are among the most common in athletes of any age group
- Anatomy of young athletes different injury patterns or conditions than adults due to growth plates
- Thorough history and physical examination correlated with understanding of the anatomy of the foot and mechanism of injury likely to ensure correct diagnosis
- Age of athlete guides the differential diagnosis, need for imaging and treatment
- Most are treated conservatively. General RTP guidelines follow
- Early intervention is key
- Proper Rehabilitation important

REFERENCES

1. Stanish WD. Lower leg, foot and ankle injuries in young athletes. Clin Sports Med 1995; 14: 651-68
2. Mafulli N. Intensive Training in young athletes. Sports Med 1990;9:229-43
3. Chambers H., Haggerty C. The Foot and Ankle in Children and Adolescents. Oper Tech Sports Med 14 (2006): 173-187
4. Chambers H. Ankle and Foot disorders in skeletally immature athletes. Orthop Clin N Am 34 (2003) 445-459
5. Pommering T., Kluchurosky L. Ankle and Foot injuries in Pediatric and Adult Athletes. Prim Care Clin Office Pract 32 (2005) 133-161
6. Malanga G., Ramirez J. Common injuries of the foot and ankle in the child and adolescent athlete. Phys Med Rehabil Clin N Am 19 (2008): 347-371
7. Houghton K. Review for the generalist: evaluation of peiatric foot and ankle pain. Pediatr Rheumatol Online J 2008; 6:6

THANK YOU FOR LISTENING!