

READING HOSPITAL SCHOOL OF
HEALTH SCIENCES
MEDICAL IMAGING PROGRAM

MI 133: CLINICAL SEMINAR II
FOREFOOT, FOOT, HEEL

PATHOLOGY & IMAGE ANALYSIS
FALL 2021

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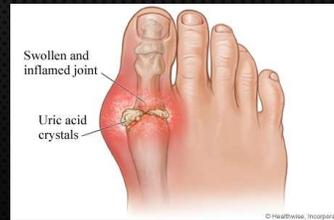
PATHOLOGY

2

GOUT

SUDDEN, SEVERE ATTACKS OF PAIN, REDNESS AND TENDERNESS IN JOINTS, OFTEN IN BIG TOE

- **CAUSES:** INCREASE OF URIC ACID IN BLOOD LEADS TO DEPOSITION OF URIC ACID CRYSTALS IN JOINTS, CARTILAGE, AND KIDNEYS
 - ENZYME DEFECTS , TRAUMA, OVERWEIGHT, EXCESSIVE ALCOHOL INTAKE, TOO MUCH MEAT AND FISH HIGH IN PURINES, MEDICATIONS (DIURETICS)
- **COMPLICATIONS:** OVER TIME, CAN HARM JOINTS, TENDONS, AND OTHER TISSUES AND CAN CAUSE KIDNEY STONES
- **RADIOGRAPHIC APPEARANCE:** DEVELOPS LATE, AFTER REPEATED ATTACKS. URATE CRYSTALS (TOPHI) FORM AND ERODE UNDERLYING BONE AT JOINT ("RAT BITE" EROSIONS – CRYSTAL LIKE LESIONS WITH OVERHANGING EDGES)
- **TECHNICAL FACTORS:** DESTRUCTIVE
- **PROGNOSIS:** EXCELLENT WITH PROPER DIAGNOSIS AND TREATMENT



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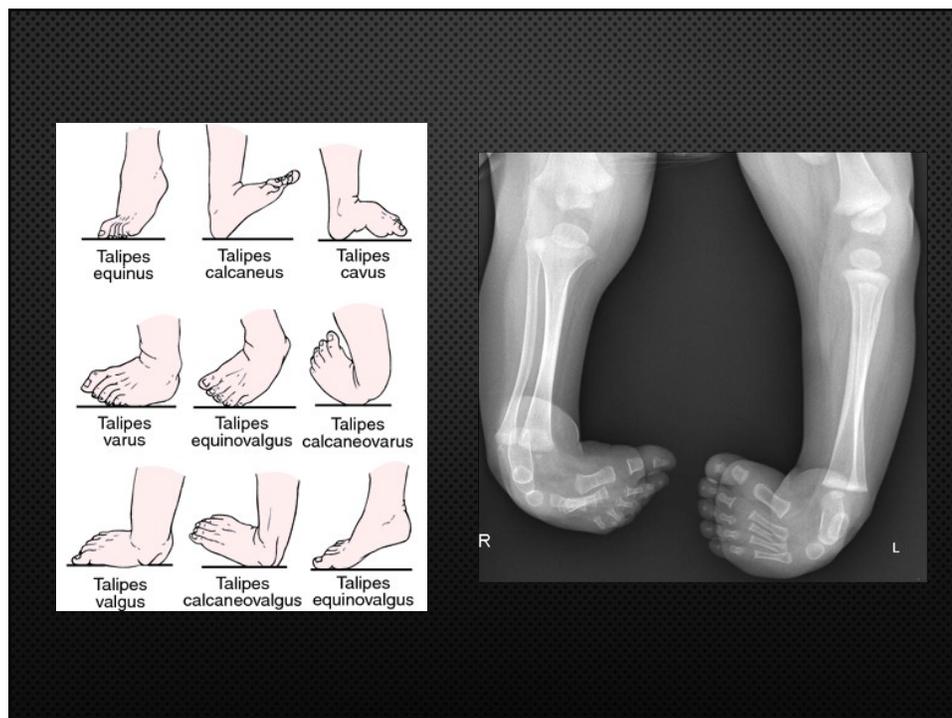
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TALIPES

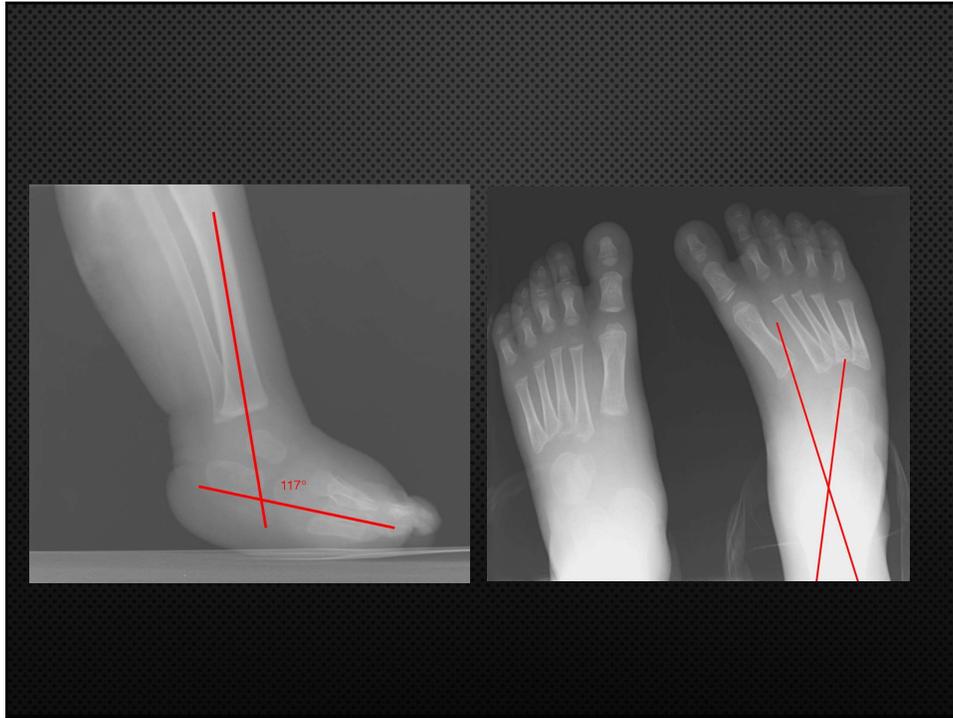
DEFORMITY IN WHICH THE FOOT IS TWISTED OUT OF SHAPE OR POSITION.

- **CAUSES:** IDIOPATHIC. INCREASED RISK WITH FAMILY HISTORY, SMOKING DURING PREGNANCY, OTHER ABNORMALITIES SUCH AS SPINA BIFIDA
- **COMPLICATIONS:** UNDERDEVELOPED CALF MUSCLES, FOOT MAY BE SHORTER, ARTHRITIS, POOR SELF IMAGE. DIFFICULTY WALKING IF NOT TREATED SHORTLY AFTER BIRTH.
- **RADIOGRAPHIC APPEARANCE:** ABNORMAL FLEXION, ABDUCTION, INVERSION AND/OR EVERSION OF FOOT
- **TECHNICAL FACTORS:** NEITHER ADDITIVE OR DESTRUCTIVE. NO CHANGE REQUIRED
- **PROGNOSIS:** MILD OR SEVERE. EVEN WITH TREATMENT, CLUBFOOT MAY NOT BE TOTALLY CORRECTABLE. BUT IN MOST CASES BABIES WHO ARE TREATED EARLY GROW UP TO WEAR ORDINARY SHOES AND LEAD NORMAL, ACTIVE LIVES.

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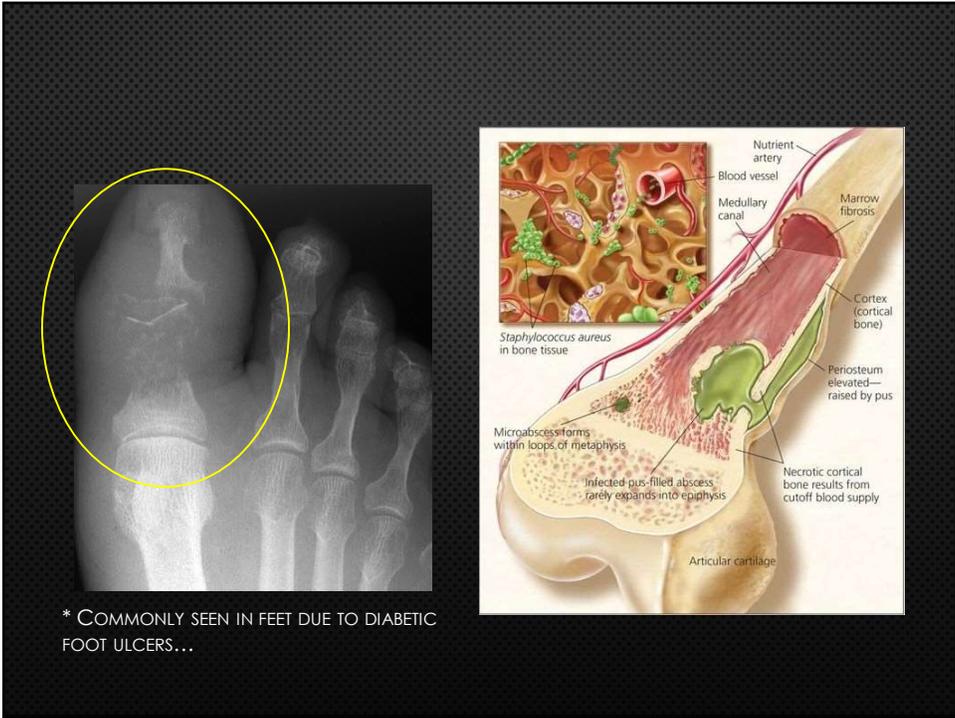
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OSTEOMYELITIS

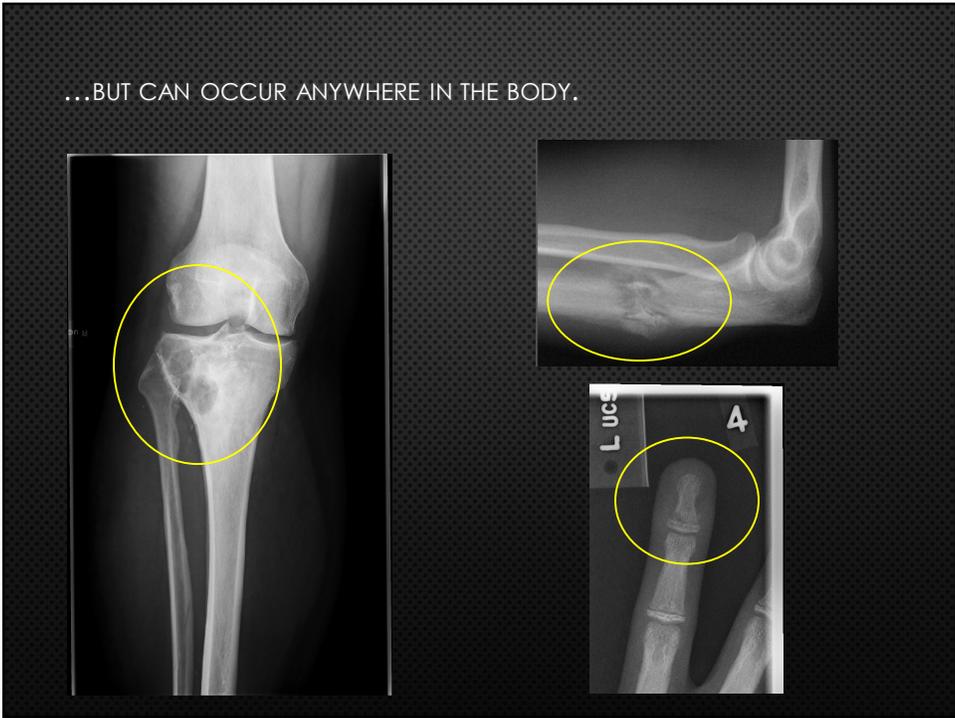
INFLAMMATION OF THE BONE (OSTEITIS) AND BONE MARROW (MYELITIS)

- **CAUSES:** BACTERIA ENTERING THE BODY FROM INJURY OR SURGERY (IATROGENIC)
- **COMPLICATIONS:** TISSUE BECOMES NECROTIC WITH POTENTIAL OF ABSCESSES FORMING; AMPUTATION
- **RADIOGRAPHIC APPEARANCE:** RAGGED, MOTH EATEN APPEARANCE
- **TECHNICAL FACTORS:** SUBTRACTIVE DISEASE - DECREASE TECHNIQUE
- **PROGNOSIS:**
 - WITH TREATMENT, THE OUTCOME FOR ACUTE OSTEOMYELITIS IS USUALLY GOOD
 - THE OUTLOOK IS WORSE FOR THOSE WITH LONG-TERM (CHRONIC) OSTEOMYELITIS

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JONES FRACTURE

MOST COMMON FRACTURE OF FOOT IS AT THE BASE OF THE 5TH METATARSAL

- **CAUSES:** TRAUMA, OCCURS WITH PLANTAR FLEXION OF FOOT
- **COMPLICATIONS:** AN AVULSION FRACTURE WITH NON-UNION
- **RADIOGRAPHIC APPEARANCE:** TRANSVERSE FRACTURE AT BASE OF 5TH METATARSAL
- **TECHNICAL FACTORS:** NEITHER ADDITIVE OR SUBTRACTIVE; NO CHANGE NECESSARY UNLESS CASTED OR SPLINTED
- **PROGNOSIS:** PRONE TO NON-UNION (WITH RATES AS HIGH AS 30 - 50%) AND ALMOST ALWAYS TAKE LONGER THAN 2 MONTHS HEAL



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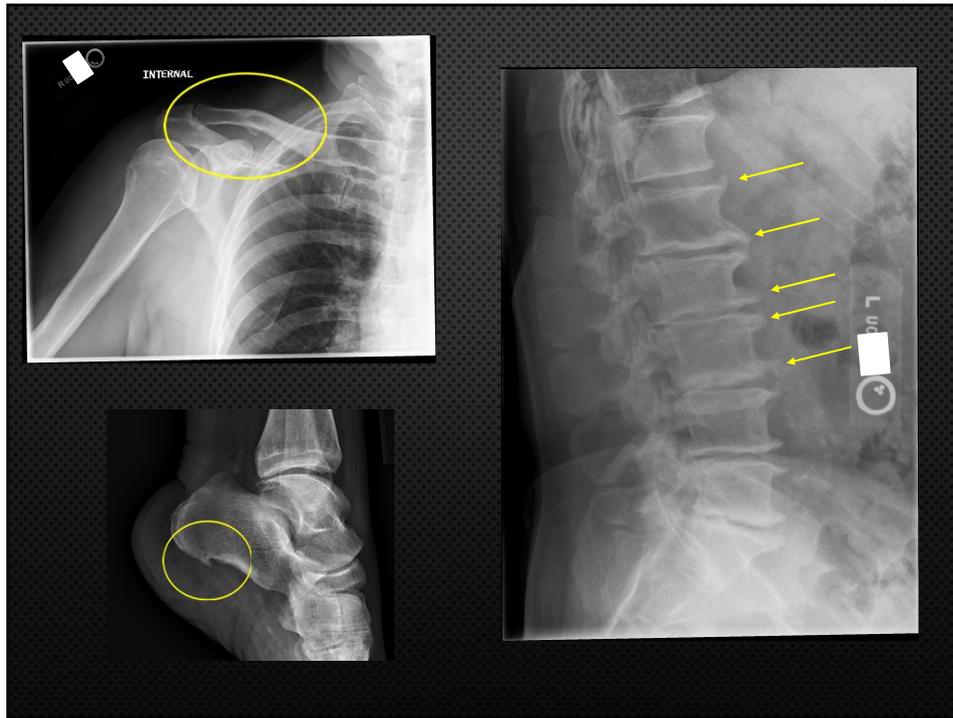
BONE SPUR

"OSTEOPHYTE" - BONY GROWTH FORMED ON NORMAL BONE

- **CAUSES:** TYPICALLY FORMS IN RESPONSE TO PRESSURE, RUBBING, OR STRESS THAT CONTINUES OVER A LONG PERIOD OF TIME.
 - COMMON PLACES FOR BONE SPURS INCLUDE THE SPINE, SHOULDERS, HANDS, HIPS, KNEES, AND FEET.
- **COMPLICATIONS:** NO SYMPTOMS OR CAN CAUSE WEAR AND TEAR OR PAIN IF IT PRESSES OR RUBS ON OTHER BONES OR SOFT TISSUES SUCH AS LIGAMENTS, TENDONS, OR NERVES IN THE BODY
- **RADIOGRAPHIC APPEARANCE:** EXTRA BONE APPEARS
- **TECHNICAL FACTORS:** ADDITIVE CONDITION, HOWEVER, NO CHANGES REQUIRED
- **PROGNOSIS:** GOOD--NO TREATMENT OFTEN NECESSARY. SPURS CAN ENLARGE AND GROW BACK.



12



13

STRESS OR FATIGUE FRACTURE “MARCH”

FRACTURES IN WEIGHT-BEARING BONES CAUSED BY REPETITIVE STRESS

- **CAUSES:** PROLONGED AND CONCENTRATED STRESS TYPICALLY TO THE FEET
- **COMPLICATIONS:** PROLONGED WEIGHT-BEARING RESTRICTIONS
- **RADIOGRAPHIC APPEARANCE:** FRACTURE LINES OR EXCESS BONY DEPOSITS AROUND REPETITIVELY HEALING FRACTURES
- **TECHNICAL FACTORS:** NEITHER ADDITIVE OR SUBTRACTIVE; NO CHANGE NECESSARY UNLESS CASTED OR SPLINTED
- **PROGNOSIS:** GOOD IF FACTORS THAT CAUSED THE FRACTURE ARE ELIMINATED



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IMAGE ANALYSIS

EI Values
All Anatomy 100 – 300

15

Toe: AP Axial

- EVIDENCE OF PROPER COLLIMATION AND THE PRESENCE OF A SIDE MARKER PLACED CLEAR OF ANATOMY OF INTEREST
- ENTIRE TOE, INCLUDING DISTAL END OF THE METATARSAL
- TOE SEPARATED FROM EACH OTHER
- NO ROTATION OF THE PHALANGES; SOFT TISSUE WIDTH AND MIDSHAFT CONCAVITY EQUAL ON BOTH SIDES
- OPEN INTERPHALANGEAL AND METATARSOPHALANGEAL JOINT SPACES ON AXIAL PROJECTIONS
- BONY TRABECULAR DETAIL AND SURROUNDING SOFT TISSUES



16

1



EI: 250

17

2



EI: 225

18

Toe: Medial Oblique

- EVIDENCE OF PROPER COLLIMATION AND THE PRESENCE OF A SIDE MARKER PLACED CLEAR OF ANATOMY OF INTEREST
- ENTIRE TOE, INCLUDING DISTAL ENDS OF THE METATARSALS
- TOES SEPARATED FROM EACH OTHER
- PROPER ROTATION OF TOE AS DEMONSTRATED BY MORE SOFT TISSUE WIDTH AND MORE MIDSHAFT CONCAVITY ON ELEVATED SIDE
- OPEN INTERPHALANGEAL AND SECOND THROUGH FIFTH METATARSOPHALANGEAL JOINT SPACES
- FIRST MTP JOINT (NOT ALWAYS OPEN)
- BONY TRABECULAR DETAIL AND SURROUNDING SOFT TISSUES



19

3



EI: 193

20

4



EI: 110

21

5



EI: 281

22

Toe: Lateral

- EVIDENCE OF PROPER COLLIMATION AND THE PRESENCE OF A SIDE MARKER PLACED CLEAR OF THE ANATOMY OF INTEREST
- ENTIRE TOE WITHOUT SUPERIMPOSITION OF ADJACENT TOES; WHEN SUPERIMPOSITION CANNOT BE AVOIDED THE PROXIMAL PHALANX MUST BE SHOWN
- TOE(S) IN TRUE LATERAL POSITION
 - TOENAIL IN PROFILE, IF VISUALIZED AND NORMAL
 - CONCAVE PLANTAR SURFACES OF THE PHALANGES
 - NO ROTATION OF THE PHALANGES
- OPEN IP JOINT SPACES; THE MTP JOINTS ARE OVERLAPPED BUT MAY BE SEEN IN SOME PATIENTS
- BONY TRABECULAR DETAIL AND SURROUNDING SOFT TISSUE

1st & 2nd unaffected side against (lateral-medial)



3rd - 5th unaffected side against (medial-lateral)



23

6



EI: 248

Absorbed Dose :
DAP : --

24

7

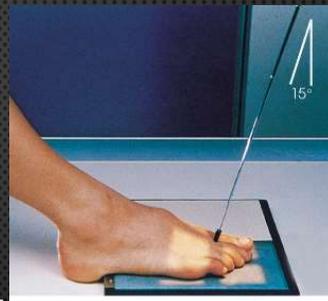


EI: 248

25

Forefoot/Toes: AP Axial

- EVIDENCE OF PROPER COLLIMATION AND THE PRESENCE OF A SIDE MARKER PLACED CLEAR OF THE ANATOMY OF INTEREST
- ENTIRE TOES, INCLUDING DISTAL ENDS OF THE METATARSALS
- TOES SEPARATED FROM EACH OTHER
- NO ROTATION OF THE PHALANGES; SOFT TISSUE WIDTH AND MIDSHAFT CONCAVITY EQUAL ON BOTH SIDES
- OPEN IP AND MTP JOINT SPACES ON AXIAL PROJECTION
- BONY TRABECULAR DETAIL AND SURROUNDING SOFT TISSUE



26

8



El: 156

27

9



El: 228

28

10



EI: 300

29

Forefoot/Toes: Medial Oblique

- EVIDENCE OF PROPER COLLIMATION AND PRESENCE OF A SIDE MARKER PLACED CLEAR OF ANATOMY OF INTEREST
- ENTIRE TOES, INCLUDING DISTAL ENDS OF THE METATARSALS
- TOES SEPARATED FROM EACH OTHER
- PROPER ROTATION OF TOES, AS DEMONSTRATED BY MORE SOFT TISSUE WIDTH AND MORE MIDSHAFT CONCAVITY ON THE ELEVATED SIDE
- OPEN IP AND SECOND THROUGH FIFTH MTP JOINT SPACES
- FIRST MTP JOINT (NOT ALWAYS OPENED)
- BONY TRABECULAR DETAIL AND SURROUNDING SOFT TISSUES



30

11



EI: 253

31

12



EI: 136

EI: 136

32

13



EI: 120

33

Foot: AP Axial

- EVIDENCE OF PROPER COLLIMATION AND THE PRESENCE OF A SIDE MARKER PLACED CLEAR OF THE ANATOMY OF INTEREST
- ANATOMY FROM TOES TO TARSAE; MAY INCLUDE PORTIONS OF THE TALUS AND CALCANEUS
- NO ROTATION OF THE FOOT, AS DEMONSTRATED BY EQUAL AMOUNTS OF SPACE BETWEEN THE SECOND THROUGH FOURTH METATARSALS
- OVERLAP OF THE SECOND THROUGH FIFTH METATARSAL BASES
- AXIAL PROJECTION RESULTING IN IMPROVED DEMONSTRATION OF INTERPHALANGEAL, METATARSOPHALANGEAL, AND TARSOMETATARSAL JOINT SPACES
- OPEN JOINT SPACE BETWEEN MEDIAL AND INTERMEDIATE CUNEIFORMS
- BONY TRABECULAR DETAIL AND SURROUNDING SOFT TISSUES



34

14



EI: 295

35

15



EI: 246

36

16



EI: 220

37

Foot: Medial Oblique

- EVIDENCE OF PROPER COLLIMATION AND THE PRESENCE OF A SIDE MARKER PLACED CLEAR OF THE ANATOMY OF INTEREST
- ENTIRE FOOT, FROM TOES TO HEEL
- PROPER ROTATION OF FOOT:
 - THIRD THROUGH FIFTH METATARSALS FREE OF SUPERIMPOSITION
 - BASES OF THE FIRST AND SECOND METATARSALS SUPERIMPOSED ON MEDIAL AND INTERMEDIATE CUNEIFORMS
 - NAVICULAR, LATERAL CUNEIFORM, AND CUBOID WITH LESS SUPERIMPOSITION THAN IN THE AP PROJECTION
- TUBEROSITY OF 5TH METATARSAL
- LATERAL TARSOMETATARSAL AND INTERTARSAL JOINTS
- SINUS TARSI
- BONY TRABECULAR DETAIL AND SURROUNDING SOFT TISSUE



38

17



EI: 195

39

18



EI: 240

40

19



EI: 198

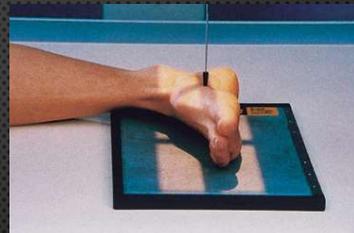
41

Foot: Lateral

- EVIDENCE OF PROPER COLLIMATION AND THE PRESENCE OF A SIDE MARKER PLACED CLEAR OF THE ANATOMY OF INTEREST
- ENTIRE FOOT AND DISTAL LEG
- SUPERIMPOSED PLANTAR SURFACES OF THE METATARSAL HEADS
- FIBULA OVERLAPPING THE POSTERIOR PORTION OF THE TIBIA
- TIBIOTALAR JOINT
- BONY TRABECULAR DETAIL AND SURROUNDING SOFT TISSUES

RH Expectations:

Entire metatarsals, not just their heads, should be superimposing on the lateral.



42

20



EI: 125

43

21



EI: 249

44

22

EI: 310



45

23



EI: 195

46

24



El: 271

47

25

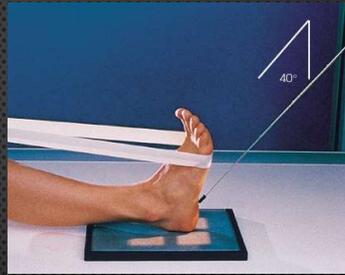
El: 266



48

Heel: AP Axial

- EVIDENCE OF PROPER COLLIMATION AND THE PRESENCE OF A SIDE MARKER PLACED CLEAR OF THE ANATOMY OF INTEREST
- CALCANEUS AND CALCANEOCUBOID JOINT
- NO ROTATION OF THE CALCANEUS- THE FIRST OR FIFTH METATARSALS NOT PROJECTED TO THE SIDES OF THE FOOT
- BONY TRABECULAR DETAIL AND SURROUNDING SOFT TISSUES
** 14th Ed of Merrill's recently updated criteria from "sub-talar joint" to **calcaneocuboid** joint.*



49

27



EI: 100

50

28



EI: 538

51

29



EI: 350

52

30

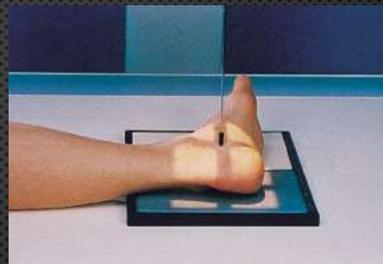


EI: 270

53

Heel: Lateral

- EVIDENCE OF PROPER COLLIMATION AND PRESENCE OF SIDE MARKER PLACED CLEAR OF ANATOMY OF INTEREST
- ENTIRE CALCANEUS, INCLUDING ANKLE JOINT AND ADJACENT TARSALS
- NO ROTATION OF THE CALCANEUS
 - TUBEROSITY IN PROFILE
 - SINUS TARSI OPEN
 - CALCANEOCUBOID AND TALONAVICULAR JOINTS OPEN
- BONY TRABECULAR DETAIL AND SURROUNDING SOFT TISSUES



54

31



EI: 285

55

32



EI: 121

56

33



EI: 280

57