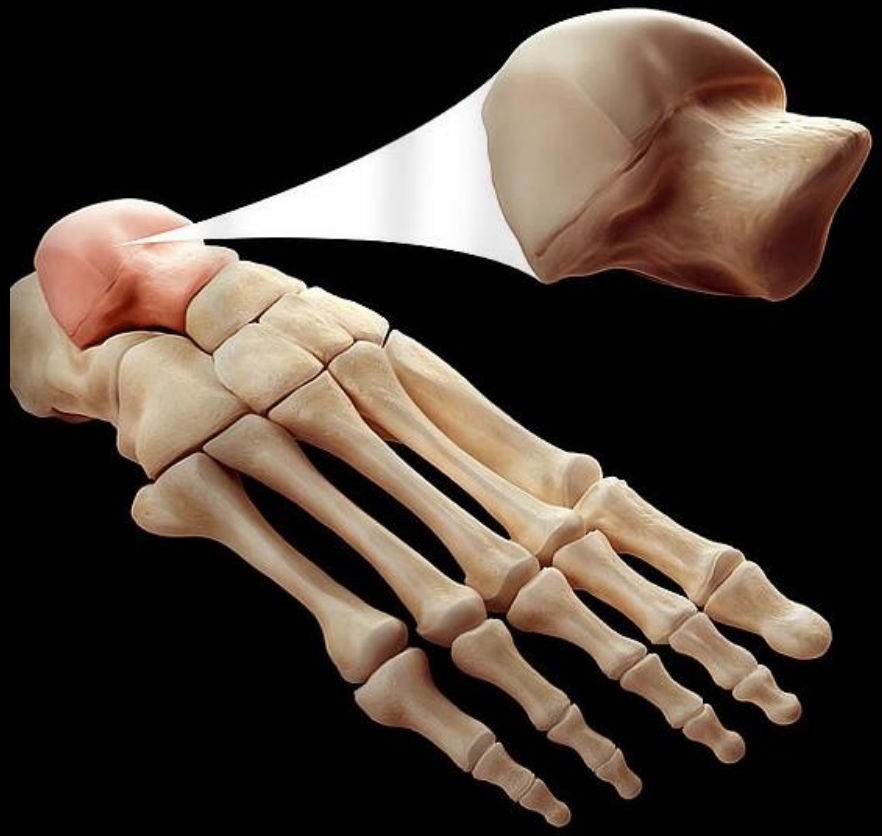
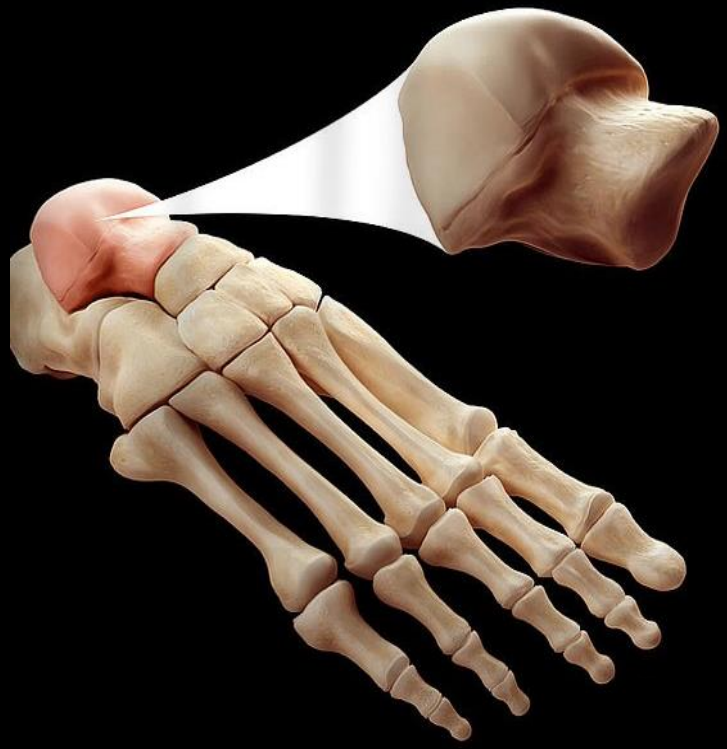


The Talus from A to Z

Eman Alqahtani, MD, MPH

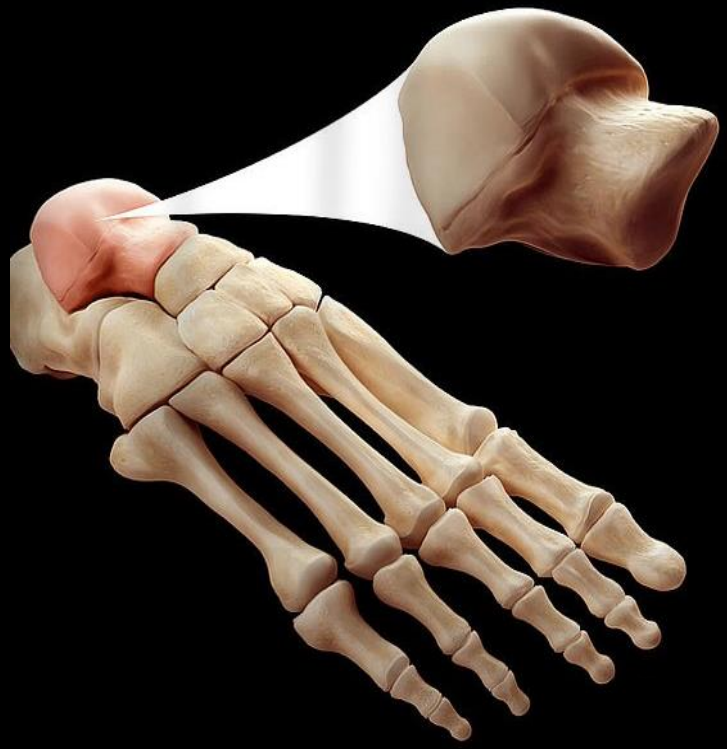
06/14/2019

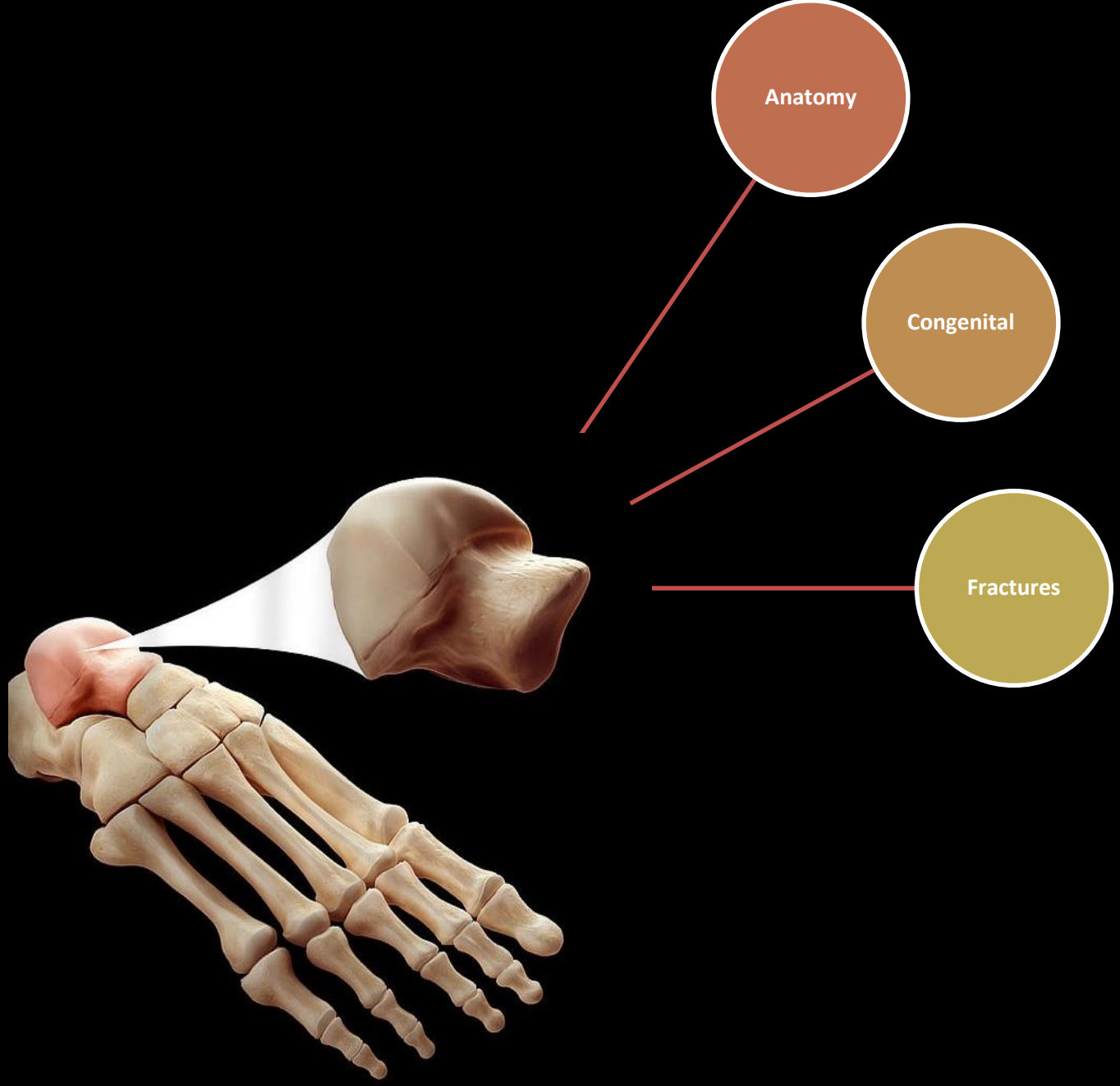
Anatomy

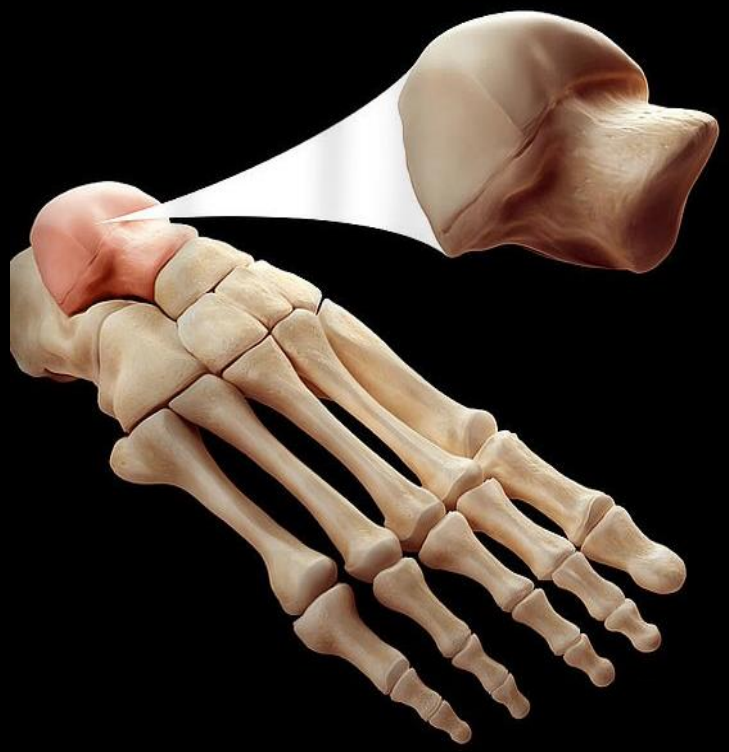


Anatomy

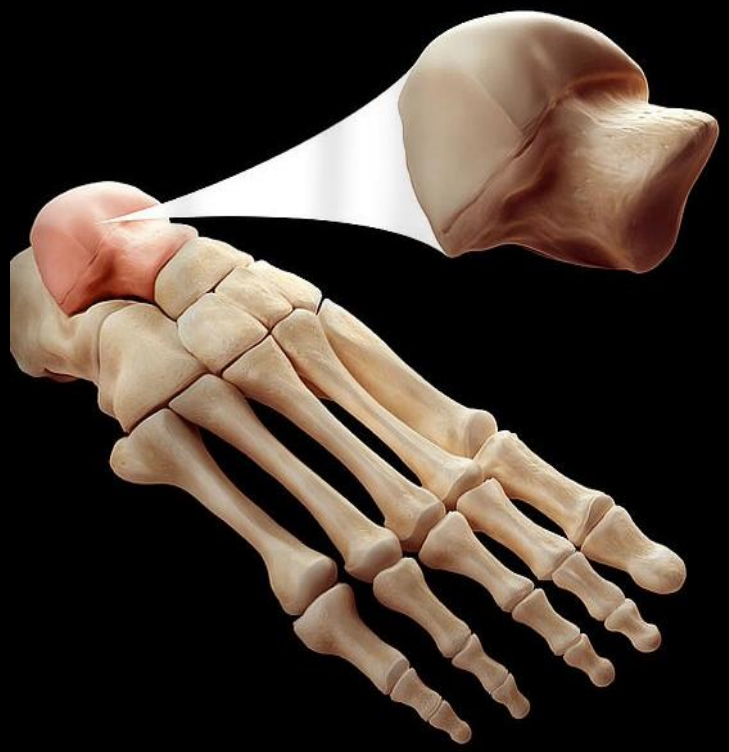
Congenital




Anatomy
Congenital
Fractures

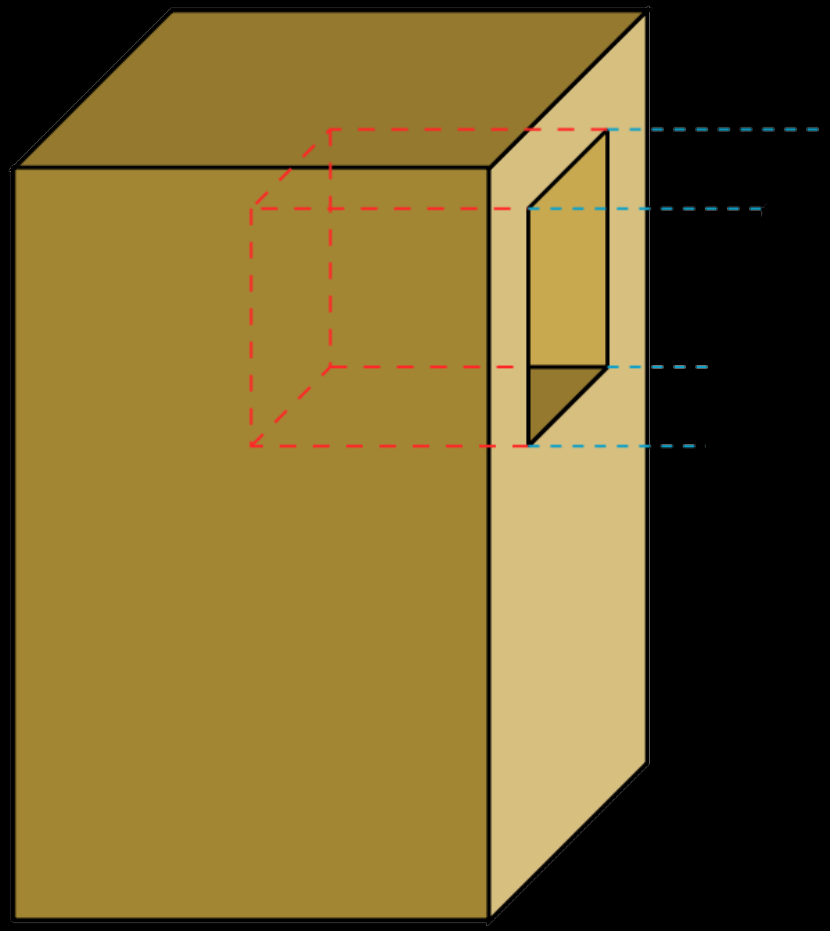


- Anatomy
- Congenital
- Fractures
- Stress related injury



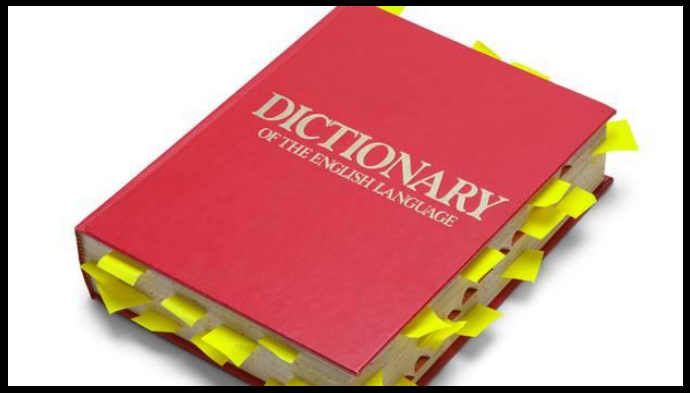
- Anatomy
- Congenital
- Fractures
- Stress related injury
- AVN

Mortise and ~~Tenon~~ The Talus



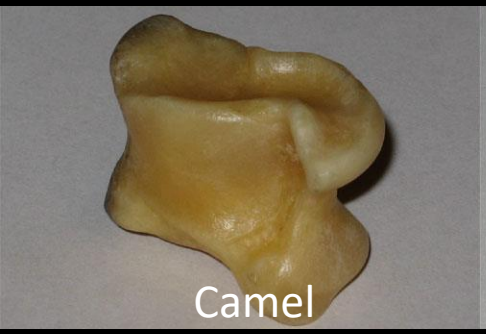
The Talus

- **Talus** definition is - a slope formed especially by an accumulation of rock debris
- **Talus also called** - Astragalus /əˈstrægələs
- Derived from the Latin word ***taxillus***, which refers to the ankle bone of a horse



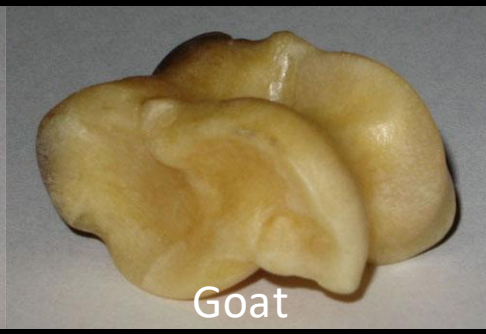
The Talus

- Shagai: Bones collected and used for traditional games and fortune-telling throughout central Asia


Camel

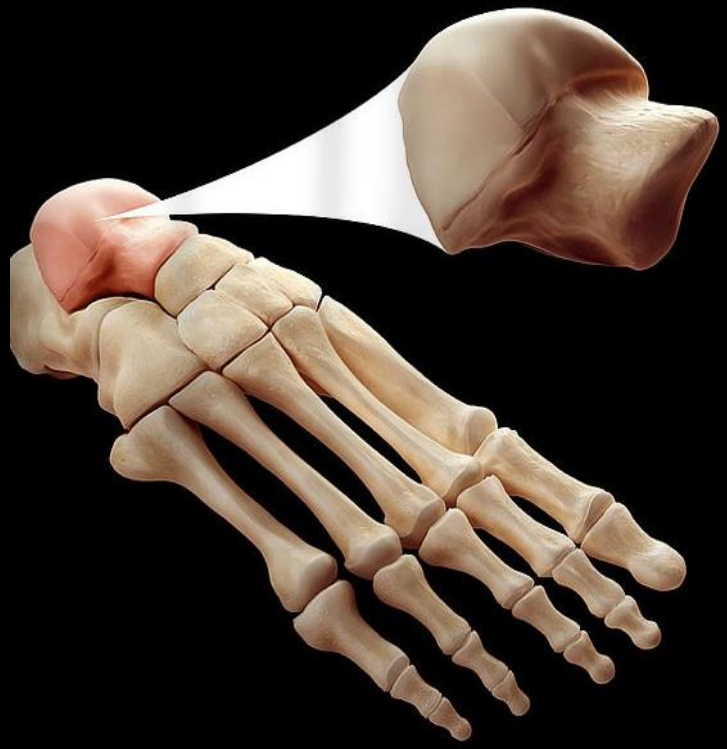

Horse


Sheep


Goat

https://en.wikipedia.org/wiki/Shagai

Anatomy



The Talus: Anatomy

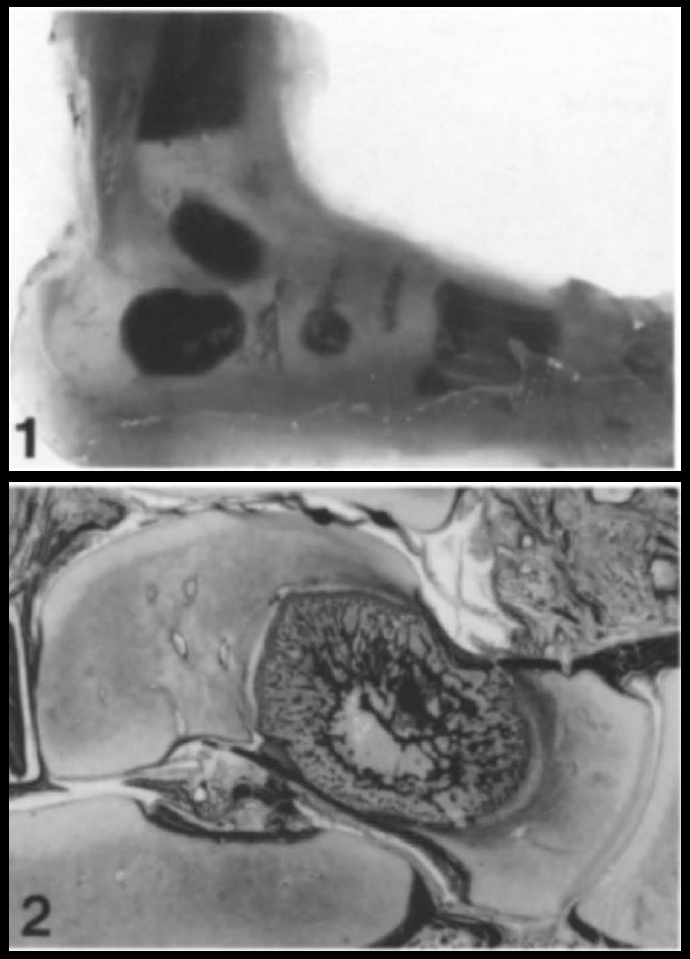
- Second largest of the tarsal bones
- Only bone articulating with the leg bones
- No muscle or tendon attachment
- Predominantly extraosseous vascular supply
- 60% covered by cartilage
- 3 parts:
  - Head
  - Neck
  - Body

The Talus: Anatomy

- The talus consists of:
  A. Two facets, one subtalar joint, and two processes
  B. Two facets, two subtalar joints, and three processes
  C. Three facets, two subtalar joints, and three processes
  D. Three facets, two subtalar joints, and two processes
  E. Three facets, three subtalar joints, and three processes

The Talus: Anatomy

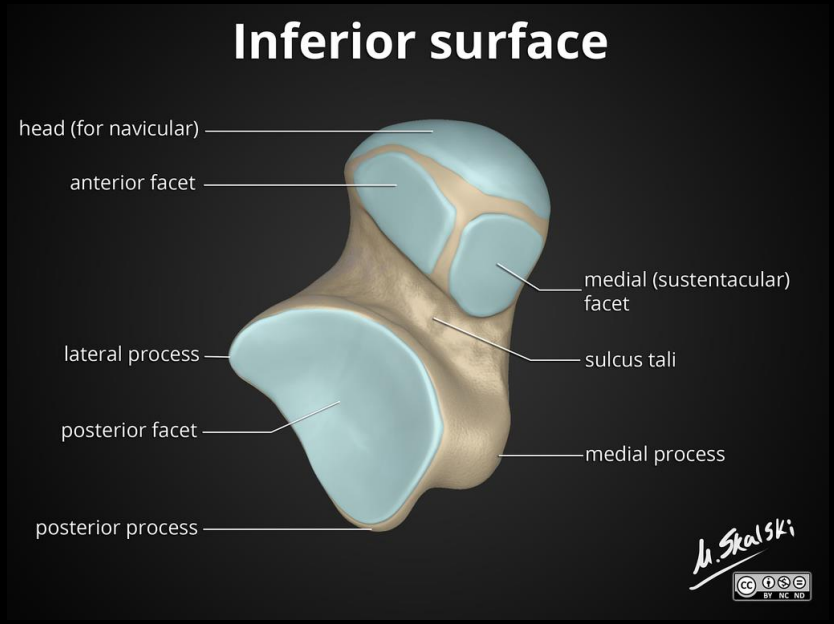
- Embryology
  - Tarsal bones mesenchymal differentiation and segmentation sometime around the *8th week* of gestation
  - Ossification of the talus originates from a *single primary center*
  - Elongation occur in an anteroposterior direction
  - In the newborn talus up to 24% of the talus already consists of bony tissue



Fritsch, Ann Anat (1996) 178: 455 -4~9

The Talus: Anatomy

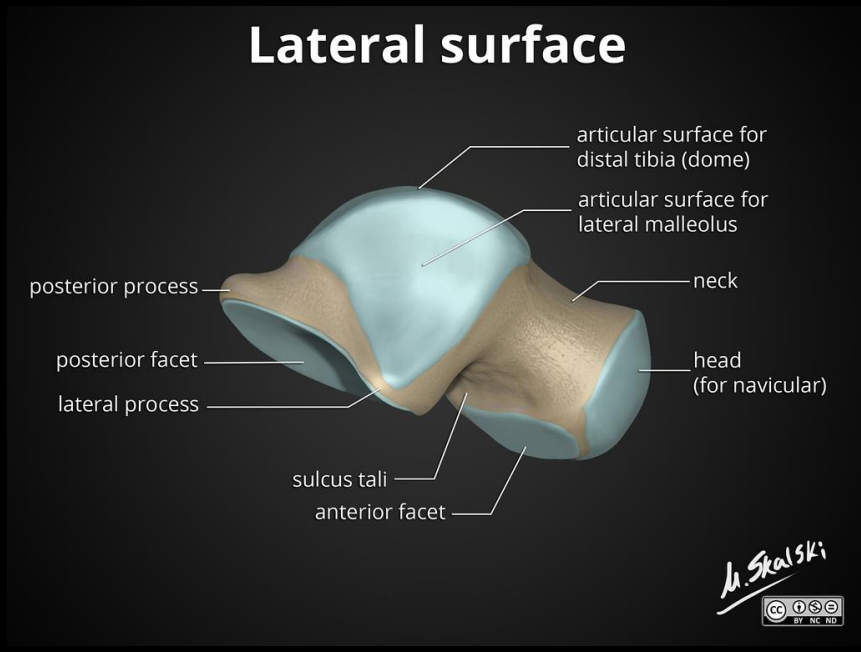
- Talar Head:
  - Covered with hyaline cartilage
  - Convex
  - Articulation:
    - Navicular anteriorly
    - Calcaneus inferiorly and medially



Anatomy of the talus , Dr Matt Skalski, radiopedia

The Talus: Anatomy

- Talar neck:
  - Directed plantar-medially
  - 150 degrees angle with the body
  - Inferior surface of the talar neck forms the tarsal canal
    - Opening into the sinus tarsi laterally
  - Tarsal canal is devoid of cartilage and is extra-articular
  - Sulcus tali:
    - Deep groove which separates middle and posterior talocalcaneal articular surfaces

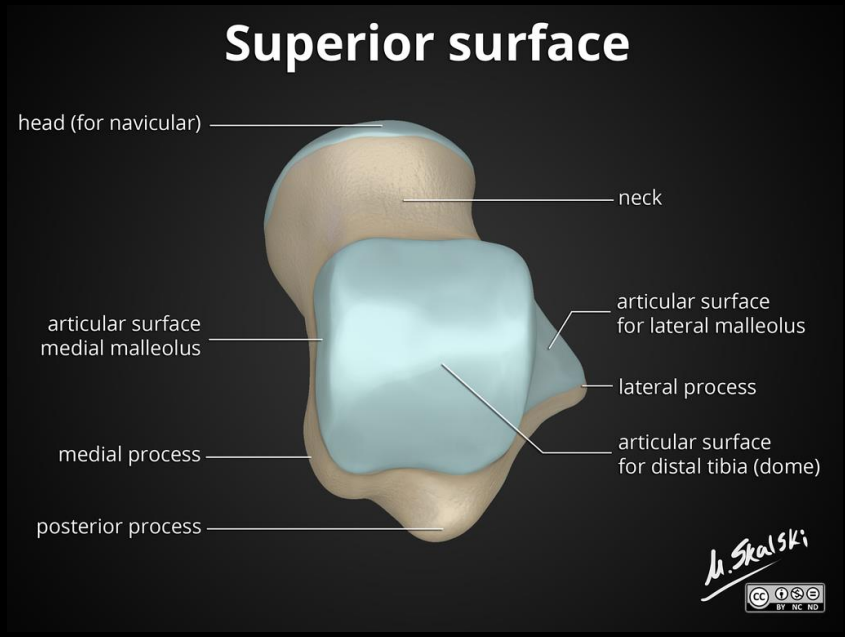


Anatomy of the talus , Dr Matt Skalski, radiopedia

https://slideplayer.com/slide/6198238/

The Talus: Anatomy

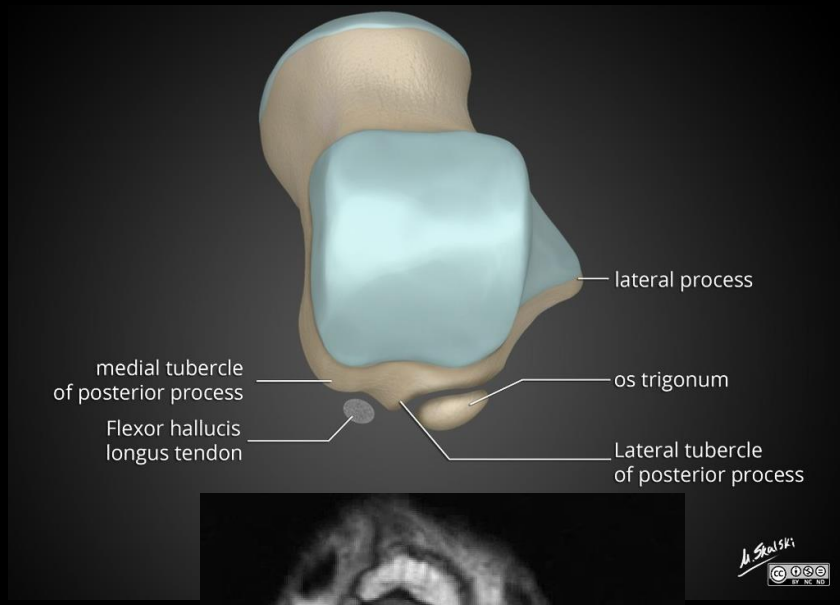
- Talar body:
  - Superior convex articular surface trochlea with shallow central groove (saddle shape)
  - Inferiorly:
    - Articulates with the calcaneus:
      - Posterior facet: larger and located posteriorly and laterally.
      - Middle facet: smaller and more medial, articulating with the calcaneal sustentaculum tali.

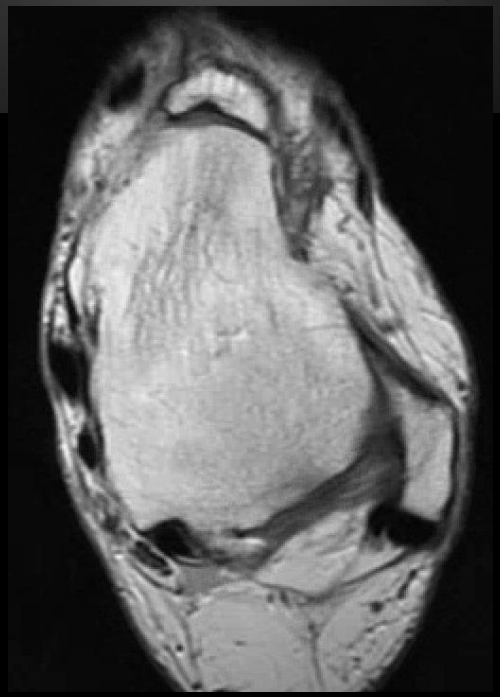


Anatomy of the talus , Dr Matt Skalski, radiopedia

The Talus: Anatomy

- Talar body:
  - Posterior Process:
    - Lateral tubercle: posterior talofibular ligament
      - » Stieda process
      - » Os trigonum: 1.7% to 50%
    - Medial tubercle: posterior fibers of the deltoid
    - Groove in between: FHL
  - Lateral Process:
    - Broad-based triangular lateral process:
      - » Articulate with the fibula superiorly
      - » Forms the posterior facet of the posterior subtalar joint





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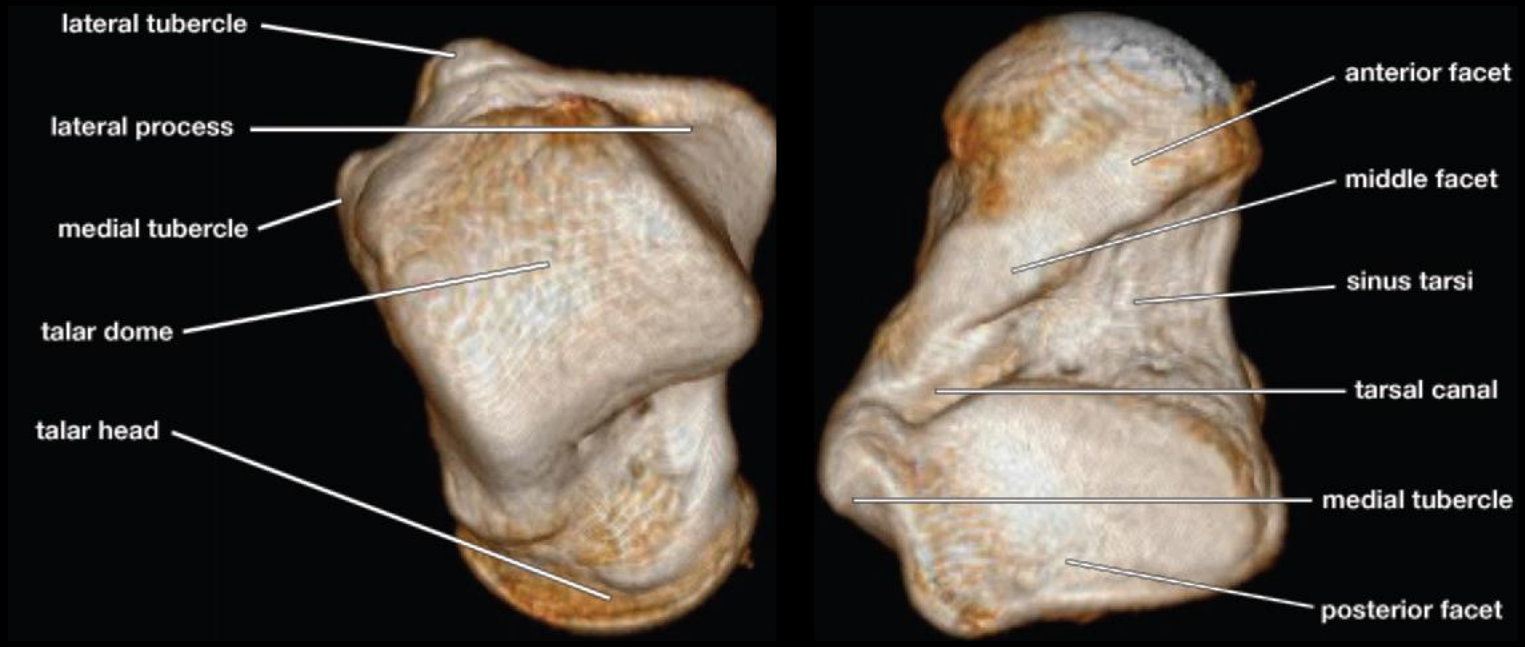
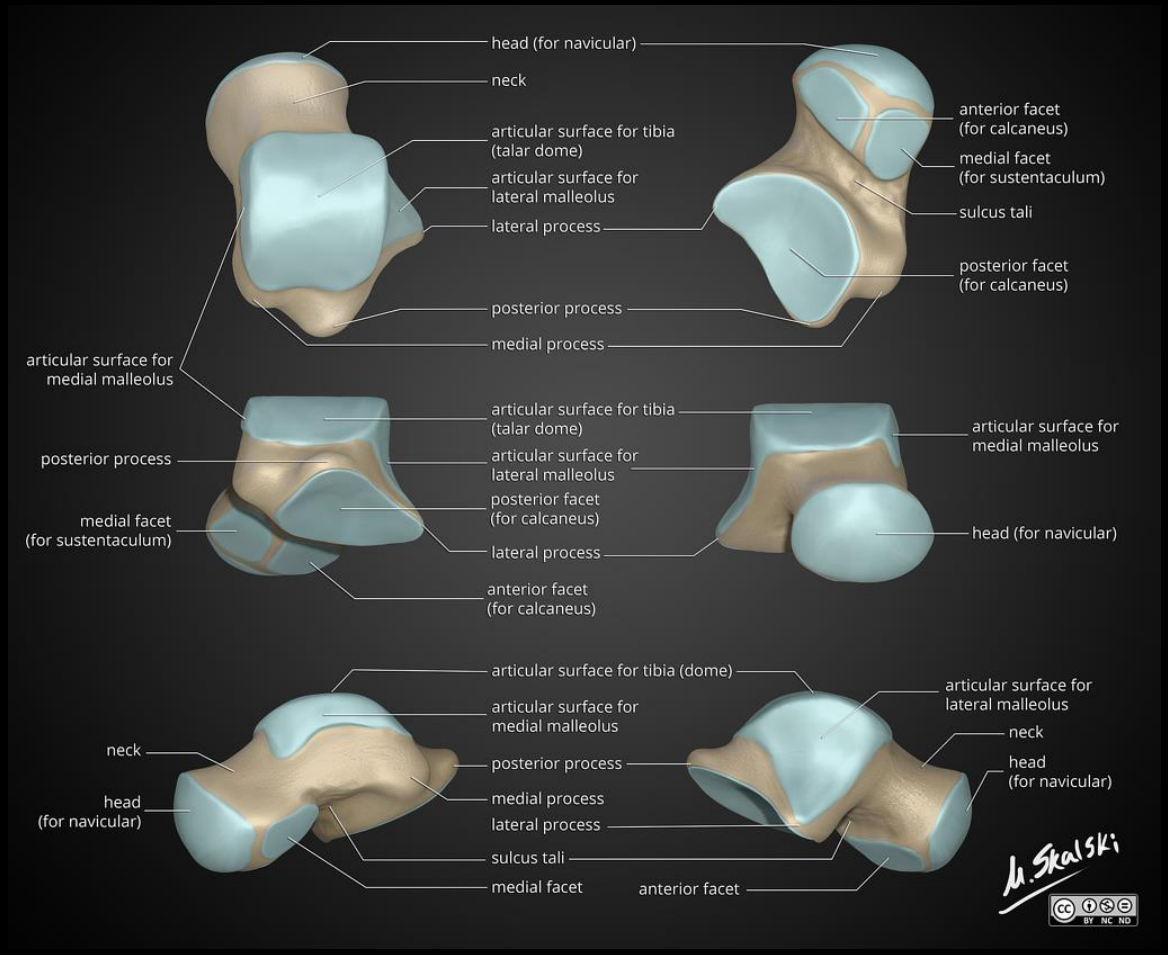
The Talus: Anatomy



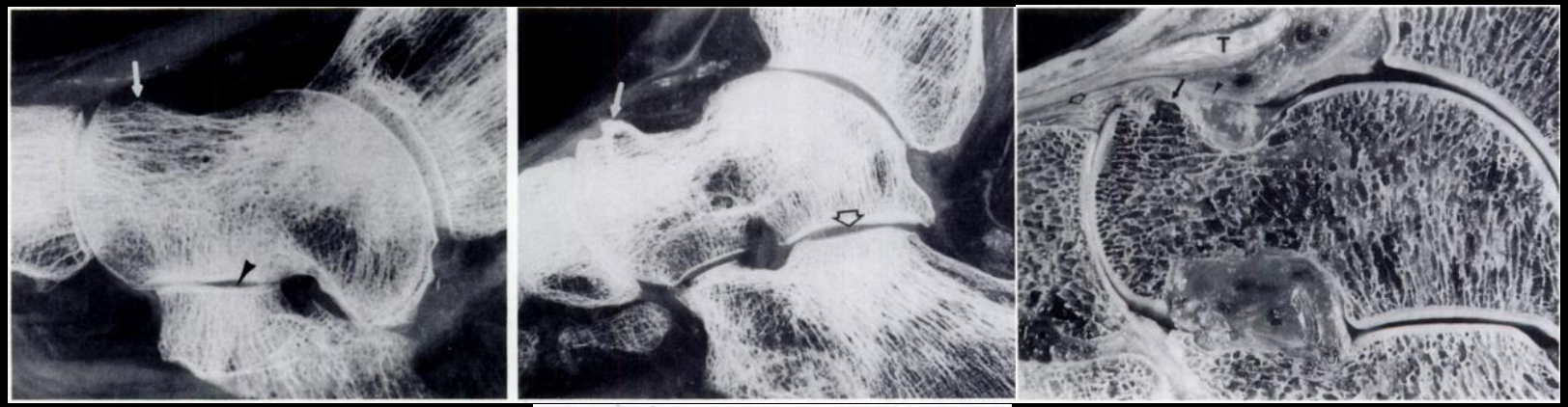
Melenevsky,, **RadioGraphics 2015**

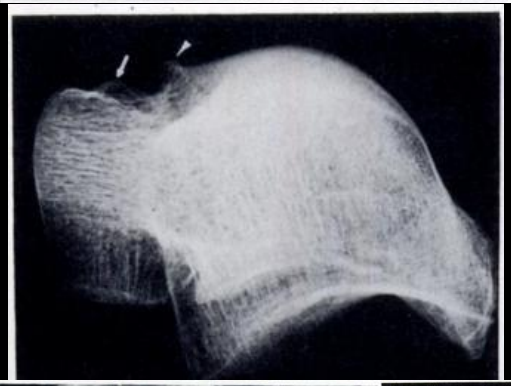
The Talus: Anatomy



Anatomy of the talus , Dr Matt Skalski, radiopedia

The Talus: Anatomy

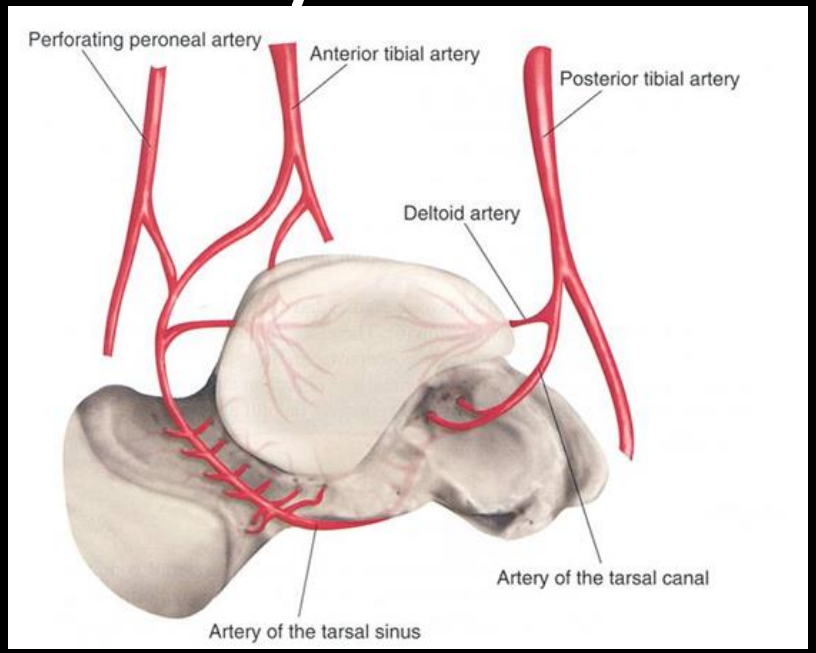




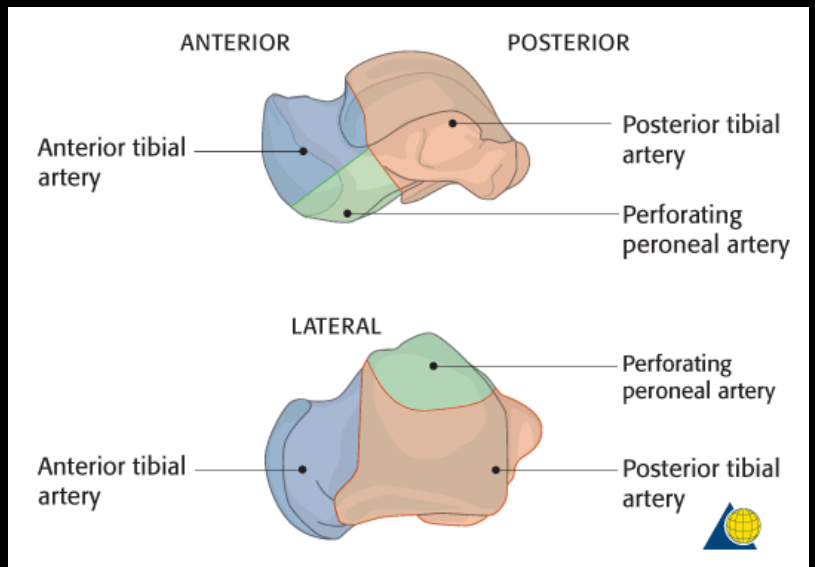
Talar ridges, osteophytes, and beaks: a radiologic commentary,
D. Resnick, 1984, Radiology

The Talus: Anatomy

- Vascular supply:
  - Posterior tibial artery- 36%
  - Dorsalis pedis artery- 47%
  - Perforating peroneal artery- 16%



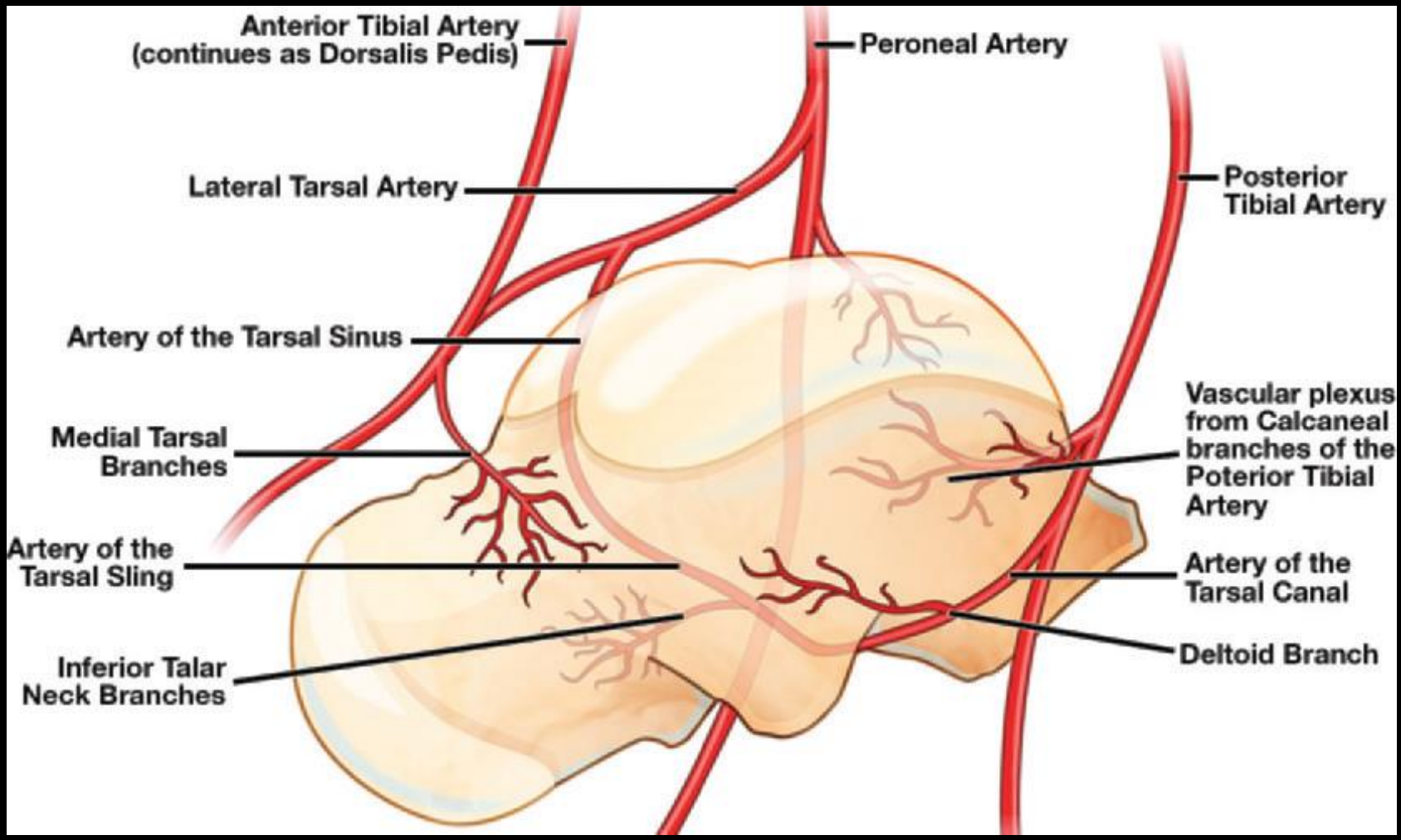
https://boneandspine.com/blood-supply-of-talus/



The Talus: Anatomy

- Posterior tibial artery:
  - The posterior tubercle branches supply:
    - Both the medial and lateral tubercles
  - The tarsal canal artery:
    - Origin: 1 cm proximal to the bifurcation into the medial and lateral plantar arteries
    - Deltoid branches
    - Courses through the tarsal canal into the sinus tarsi
    - At the sinus tarsi, it forms an anastomosis with the tarsal sinus artery
- Tarsal sinus artery:
    - Branches from an anastomotic loop between the perforating peroneal artery and the lateral tarsal artery

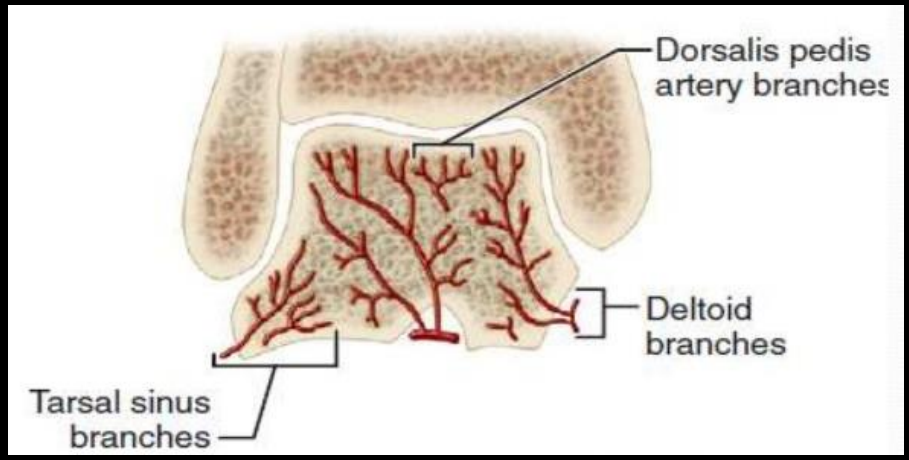
The Talus: Anatomy



Melenevsky,, **RadioGraphics 2015**

The Talus: Anatomy

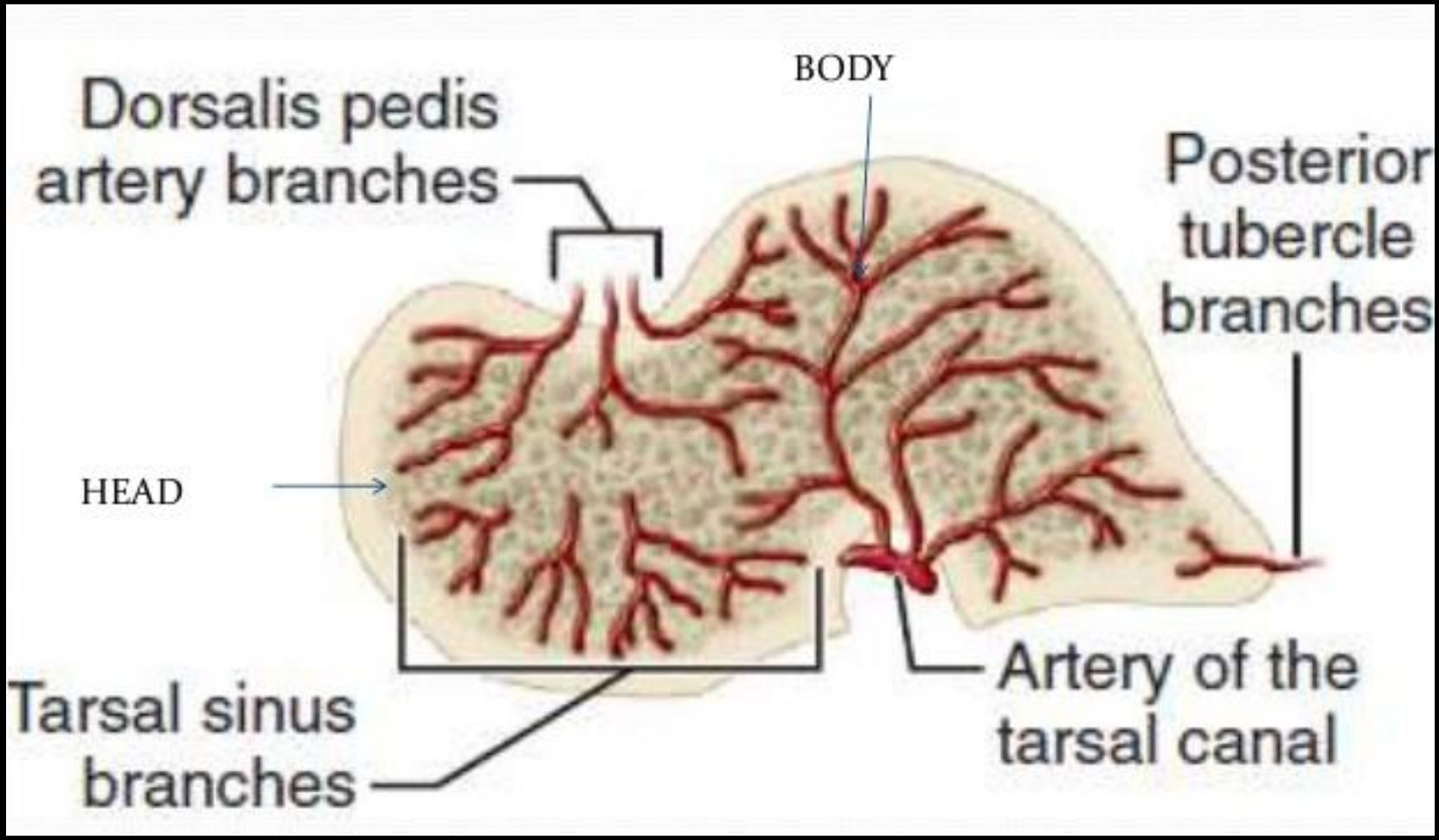
- Talar body blood supply:
  - Tarsal canal artery:
    - Supplies the central and lateral two-thirds of the talar body
    - The remaining medial third of the talar body receives deltoid branches, arising from the tarsal canal artery



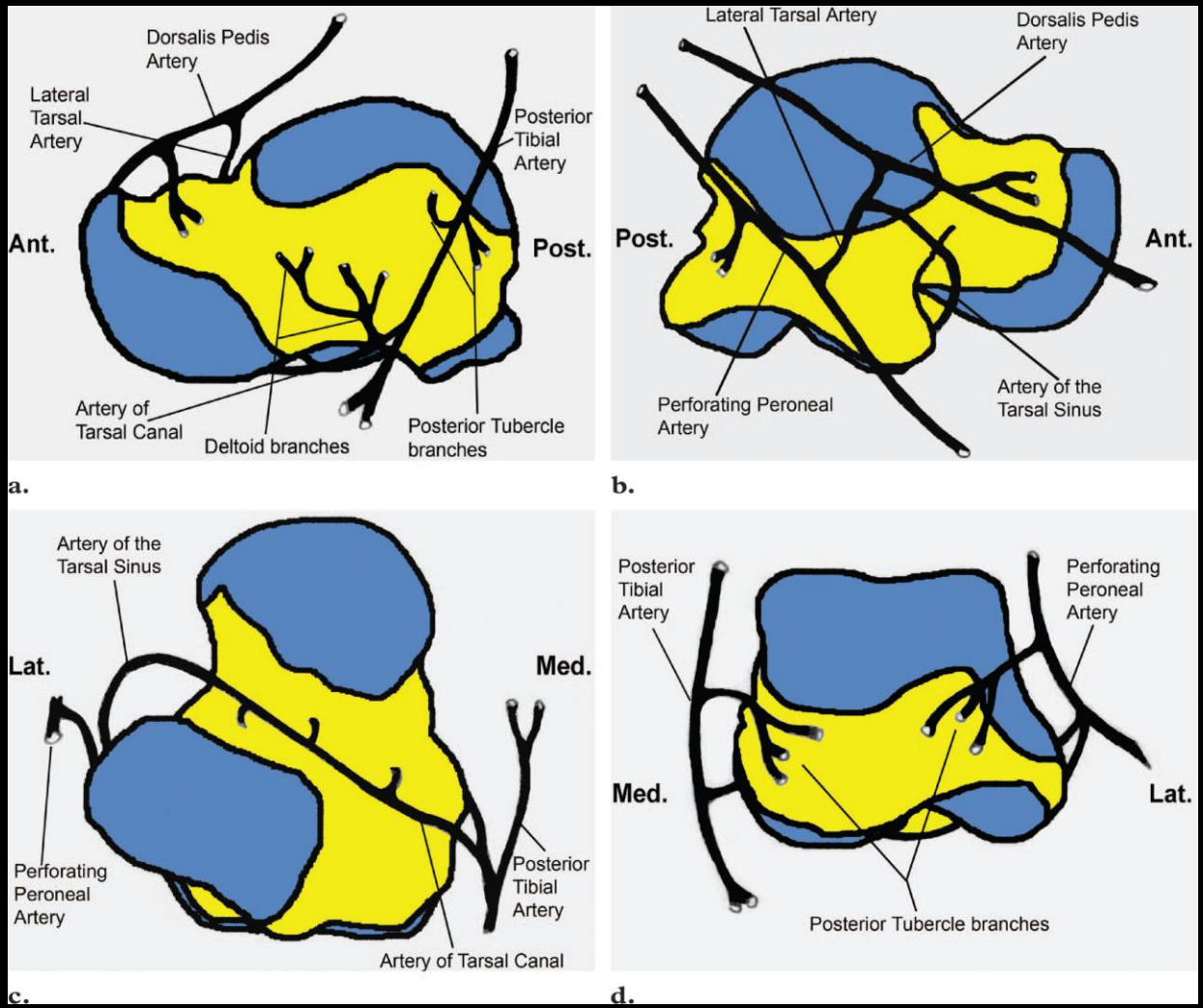
The Talus: Anatomy

- Talar neck blood supply:
  - The superomedial half of the talar neck and head is supplied by branches of the anterior tibial artery
  - The inferolateral half may be supplied:
    - Tarsal sinus artery
    - Branches of anastomosis of the tarsal sinus artery and the tarsal canal artery
    - Lateral tarsal artery, which arises from the dorsalis pedis artery

The Talus: Anatomy

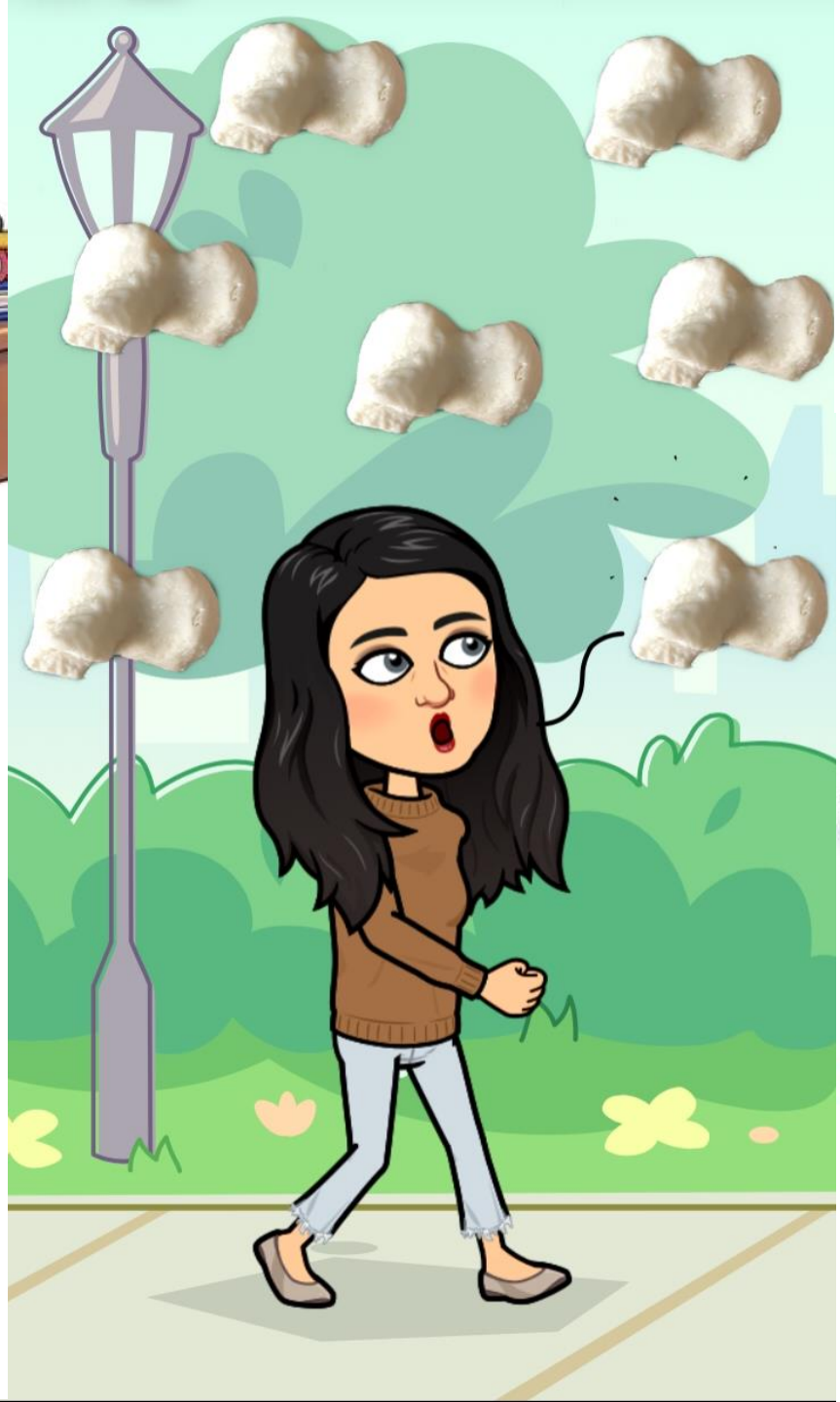


The Talus: Anatomy



Pearce, **RadioGraphics 2005**

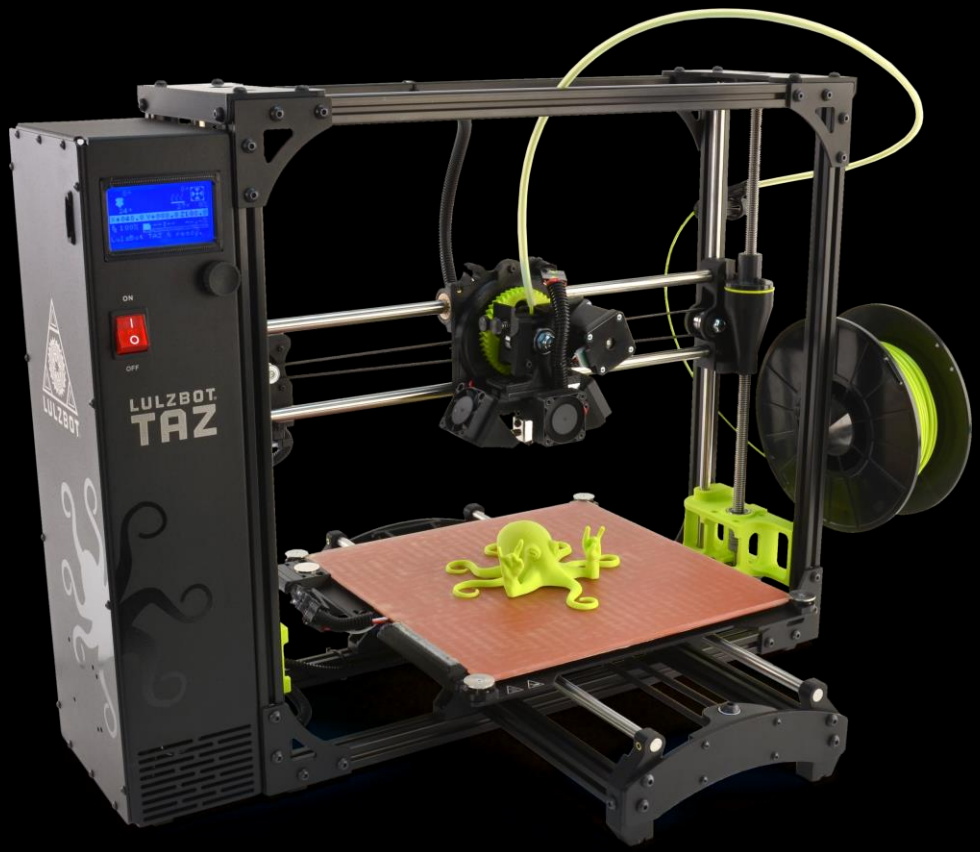

COOL
MOM




Retail Therapy

The Talus

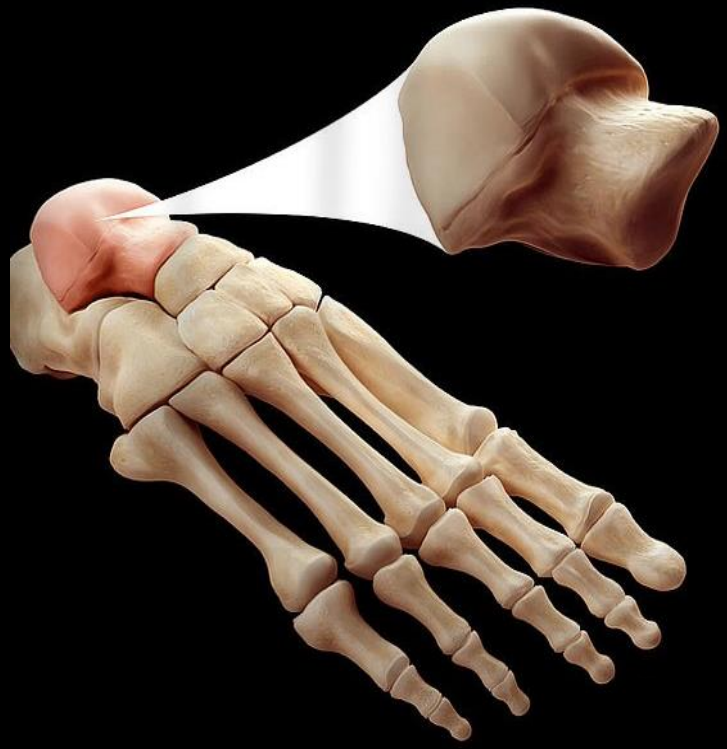
- Rady Children's Hospital 3D Printing Lab



Special thanks to:
Dr. John Naheedy
Dr. Jerry Dewek
Dr. Daniel Vincour

Anatomy

Congenital



The Talus: Congenital Anomalies

- Congenital Vertical Talus (CVT)
- Clubfoot
- Talar coalition
- Accessory anterolateral talar facet (AALTF)

The Talus: Congenital Anomalies

- **Congenital Vertical Talus**
  - **Rocker bottom foot**
  - Prominent calcaneus/heel and a convexly rounded sole
  - Irreducible dorsal dislocation of the navicular on the talus producing a rigid flatfoot deformity present at birth

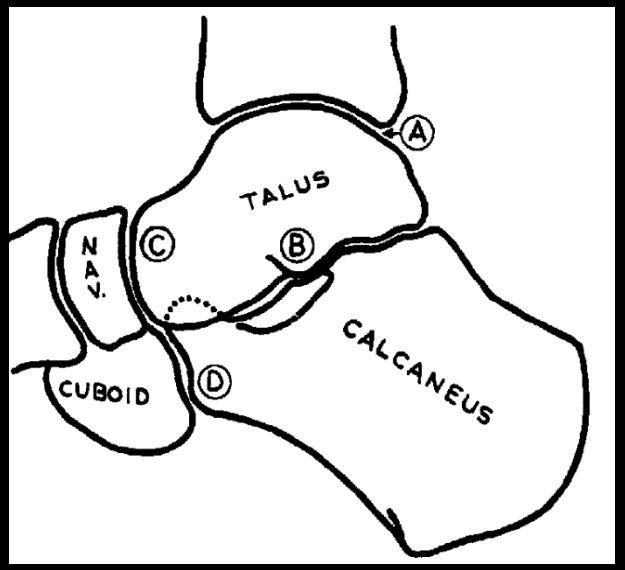
https://www.orthobullets.com/pediatrics/4066/congenital-vertical-talus

Khoshnaw et al, Radiopaedia

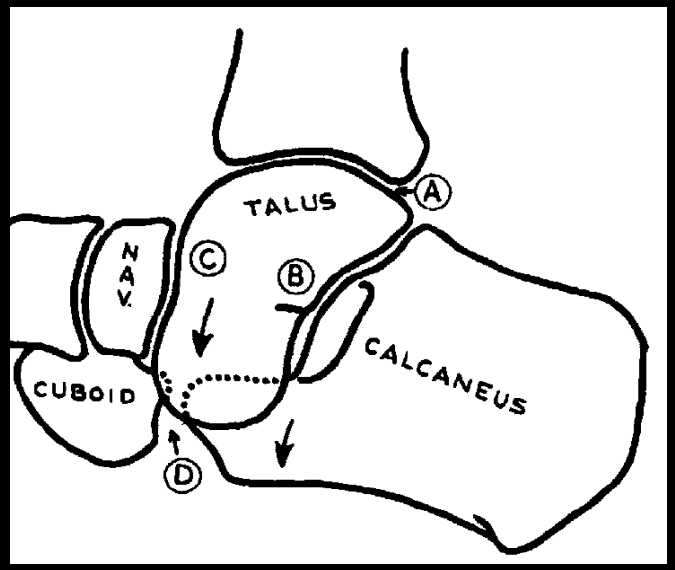
The Talus: Congenital Anomalies

- **Congenital Vertical Talus**

Normal



CVT



HAVESON, et al **Congenital Flatfoot Due to Talonavicular Dislocation (Vertical Talus)**

The Talus: Congenital Anomalies

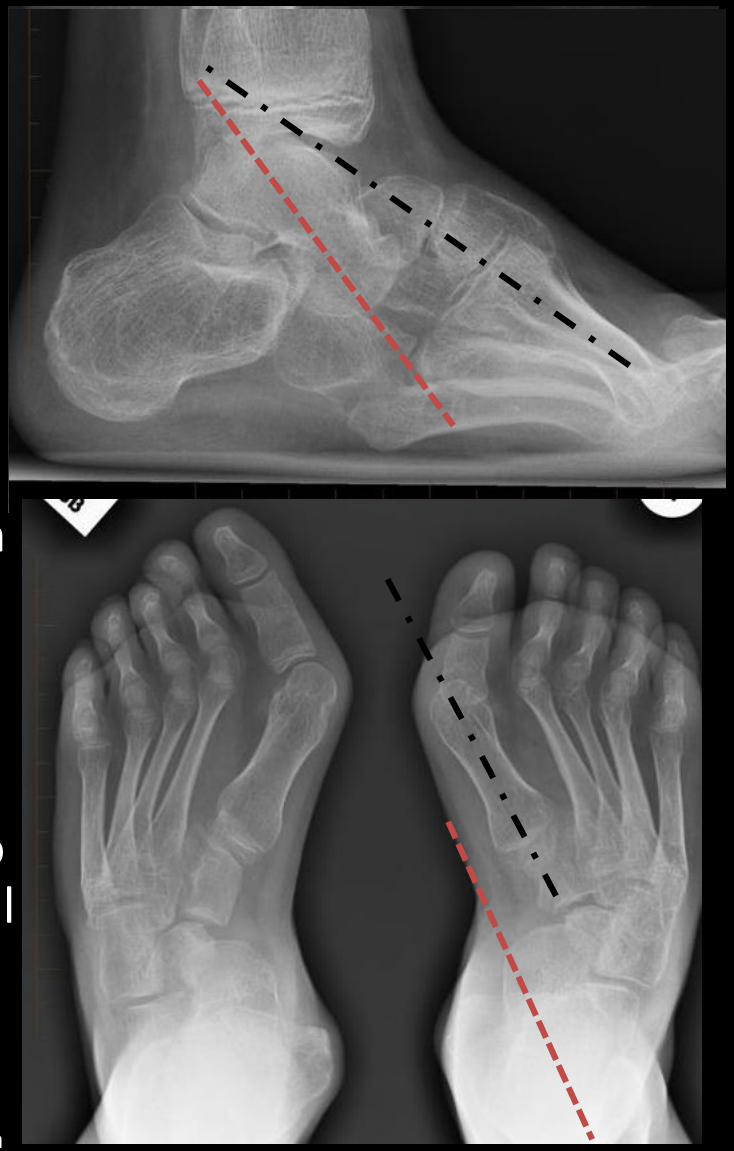
- **Congenital Vertical Talus**
  - Epidemiology:
    - Rare, 1:150,000 births
    - 50% associated with neuromuscular disease chromosomal aberrations
  - 50% bilateral
  - M:F ratio of 2:1

The Talus: Congenital Anomalies

- **Congenital Vertical Talus**
  - Association:
    - Trisomy 13, 18
    - Myelomeningocele
    - Arthrogryposis
    - Diastematomyelia
    - Congenital dislocation of the hip
    - Cerebral palsy
    - Spinal muscular atrophy

The Talus: Congenital Anomalies

- **Congenital Vertical Talus**
  - Radiologic features:
    - Fixed equinus: plantarflexion of the calcaneus
    - Vertical talus: plantarflexion of the talus
    - Irreducible dorsal navicular dislocation
    - Forefoot valgus: divergence of the metatarsal bases (AP) and superimposition of the metatarsal bones (lateral)
    - Long axis of the talus passes plantar to the metatarsal axis (lateral) and medial to the first metatarsal (AP)



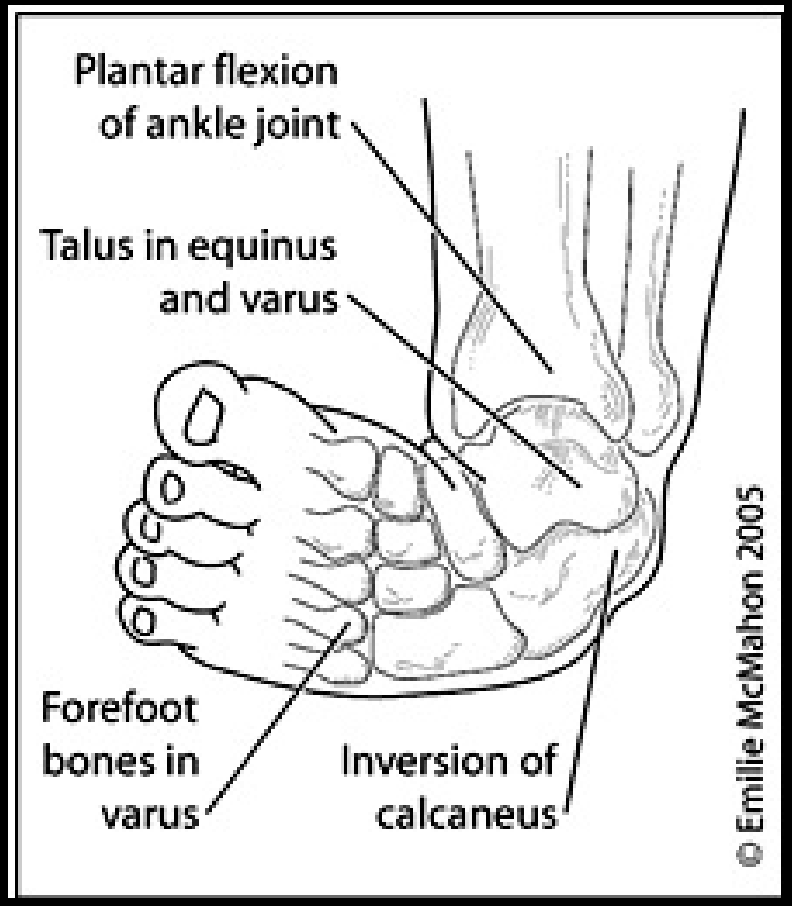
Khoshnaw et al, Radiopaedia

The Talus: Congenital Anomalies

- **Congenital Talipes equinovarus:**
  - **ClubFoot**
  - Idiopathic deformity of the foot of unclear etiology

The Talus: Congenital Anomalies

- **Clubfoot (congenital talipes equinovarus):**



The Talus: Congenital Anomalies

- **Clubfoot (congenital talipes equinovarus):**
  - Most common musculoskeletal birth defect
  - Overall incidence 1:1,000, though some populations 1:250 (Hawaiians and Maoris)
  - Male:female ratio 2:1
  - 50% bilateral
  - May be idiopathic, neurogenic, or syndrome-associated
  - 80% isolated

The Talus: Congenital Anomalies

- **Clubfoot (congenital talipes equinovarus):**
- Pathophysiology
  - Muscle contractures contribute to the characteristic deformity that includes (*CAVE*)
    - *C*avus (tight intrinsics, FHL, FDL)
    - *A*dductus of forefoot (tight tibialis posterior)
    - *V*arus (tight tendoachilles, tibialis posterior, tibialis anterior)
    - *E*quinus (tight tendoachilles)

The Talus: Congenital Anomalies

- **Clubfoot (congenital talipes equinovarus):**
- Pathophysiology
  - Genetics
    - Genetic component is strongly suggested
    - Unaffected parents with affected child have 2.5% - 6.5% chance of having another child with a clubfoot
    - Familial occurrence in 25%
    - Recent link to *PITX1,* transcription factor critical for limb development
    - Common genetic pathway may exist with congenital vertical talus

The Talus: Congenital Anomalies

- **Clubfoot (congenital talipes equinovarus):**
- Pathophysiology
  - Associated conditions
    - Arthrogryposis
    - Diastrophic dysplasia
    - Myelodysplasia
    - Tibial hemimelia
    - Amniotic band syndrome (streeter dysplasia)
      - Upper extremity and hand anomalies common in this population
    - Pierre robin syndrome
    - Opitz syndrome
    - Larsen syndrome
    - Prune-belly syndrome
    - Anterior tibial artery hypoplasia or absence is common, regardless of etiology of clubfoot

The Talus: Congenital Anomalies

- **Clubfoot (congenital talipes equinovarus):**
  - Radiologic features:
    - Hindfoot equinus**:** lateral talocalcaneal angle less than 35º
    - Hindfoot varus**:** talocalcaneal angle less than 20º
    - Metatarsus adductus
    - Talonavicular subluxation: medial subluxation of the navicular on the talus

Donnelly, Pediatric Imaging: The Fundamentals
Goel et al, Radiopaedia

The Talus: Congenital Anomalies

- **Clubfoot (congenital talipes equinovarus):**

Frontal talocalcaneal angle

Lateral talocalcaneal angle

Donnelly, Pediatric Imaging: The Fundamentals

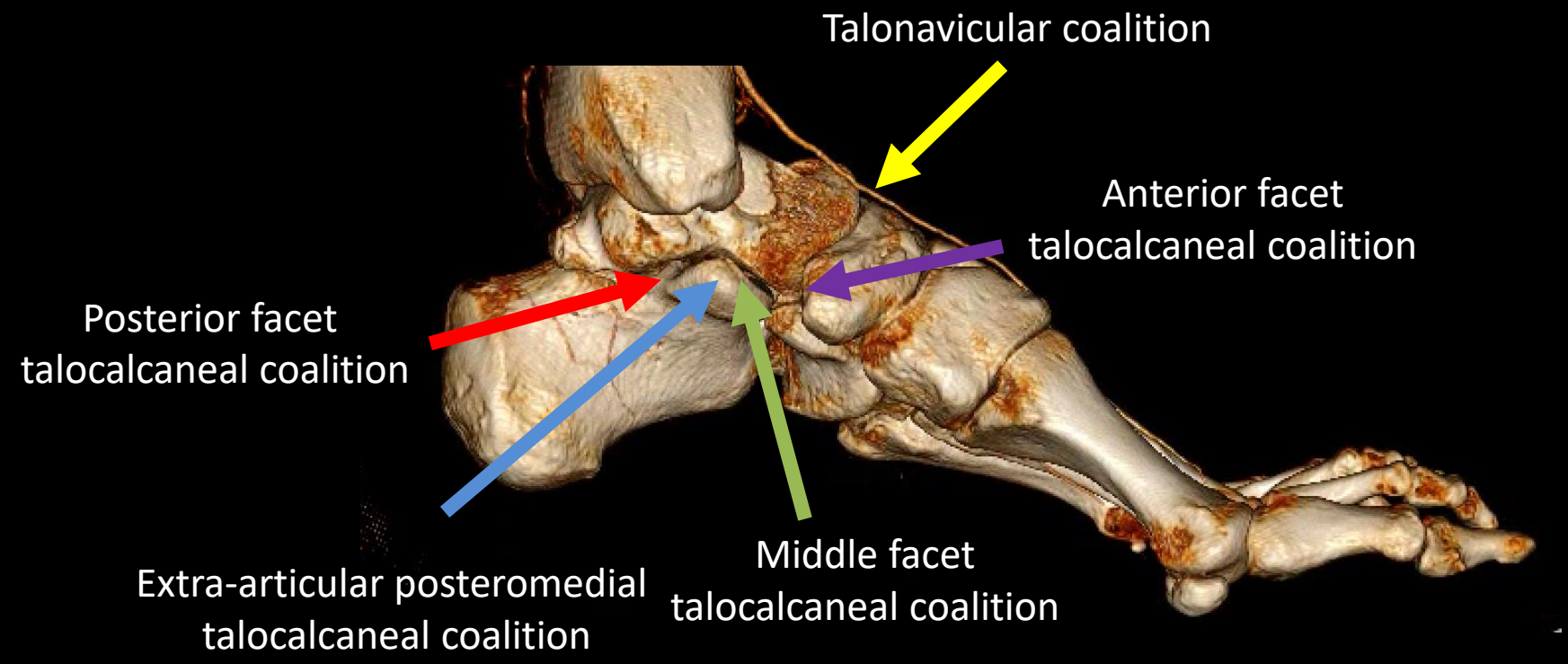
https://www.etsy.com

The Talus: Coalition

- Tarsal Coalition:
  - Abnormal union between two tarsal bone:
    - Osseous (synostosis)
    - Cartilaginous (synchondrosis)
    - Fibrous (syndesmosis)
  - Any age:
    - Hindfoot and midfoot pain
    - Frequent ankle sprains
    - Rigid flatfoot
  - Incidence of 1–2%

The Talus: Congenital Anomalies

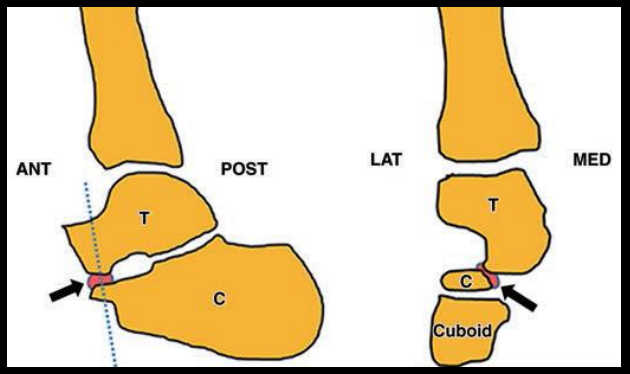
- Talus coalition:



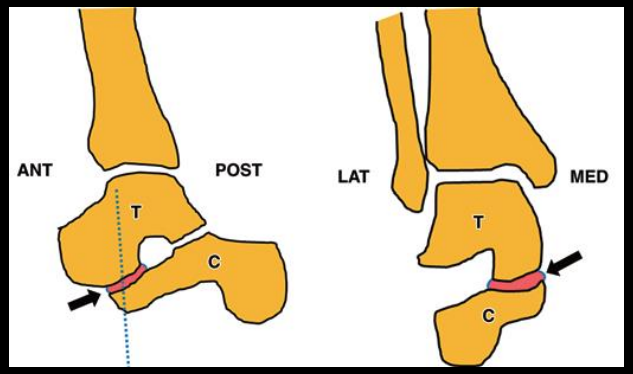
The Talus: Congenital Anomalies

- Talus Coalition:

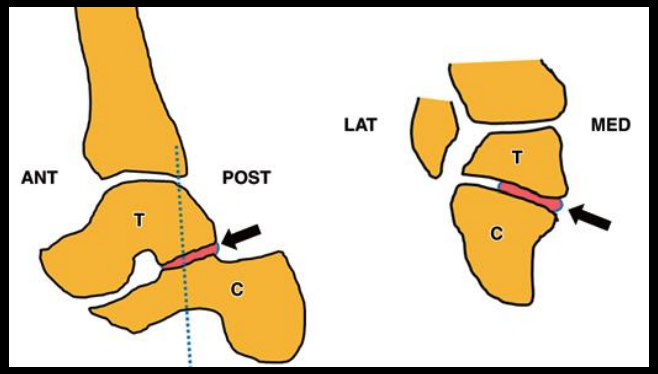
Anterior facet TCC



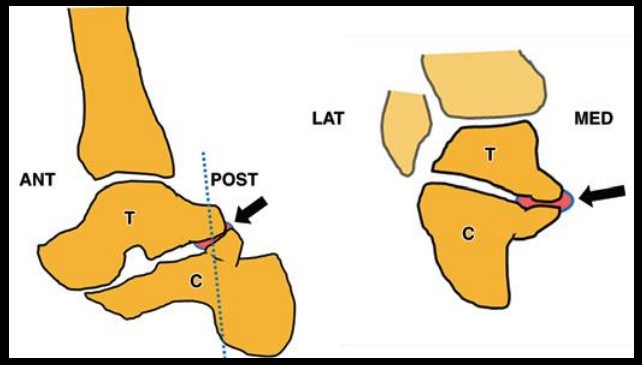
Middle facet TCC



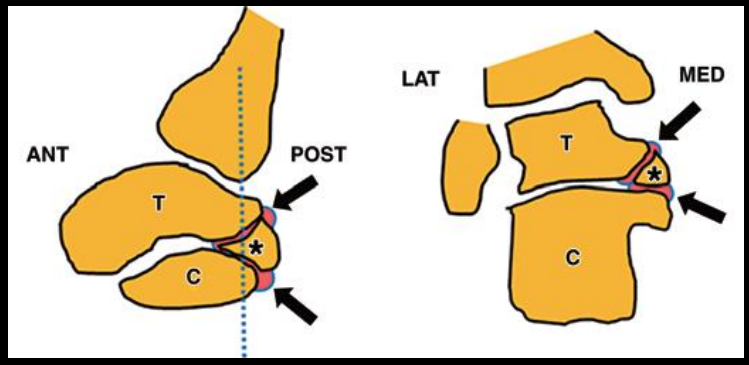
Posterior facet TCC



Extraarticular TCC



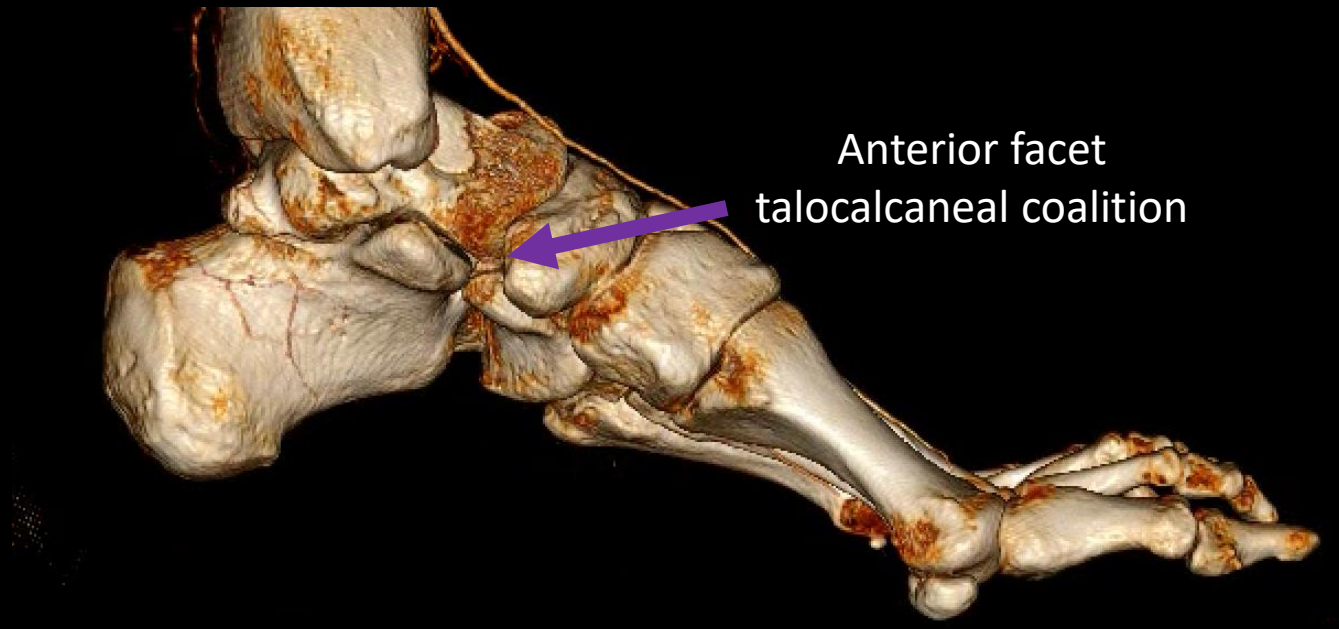
Extraarticular TCC with os sustentaculum



Yun, et. al, AJR:205, December 2015

The Talus: Congenital Anomalies

- Talus Coalition:

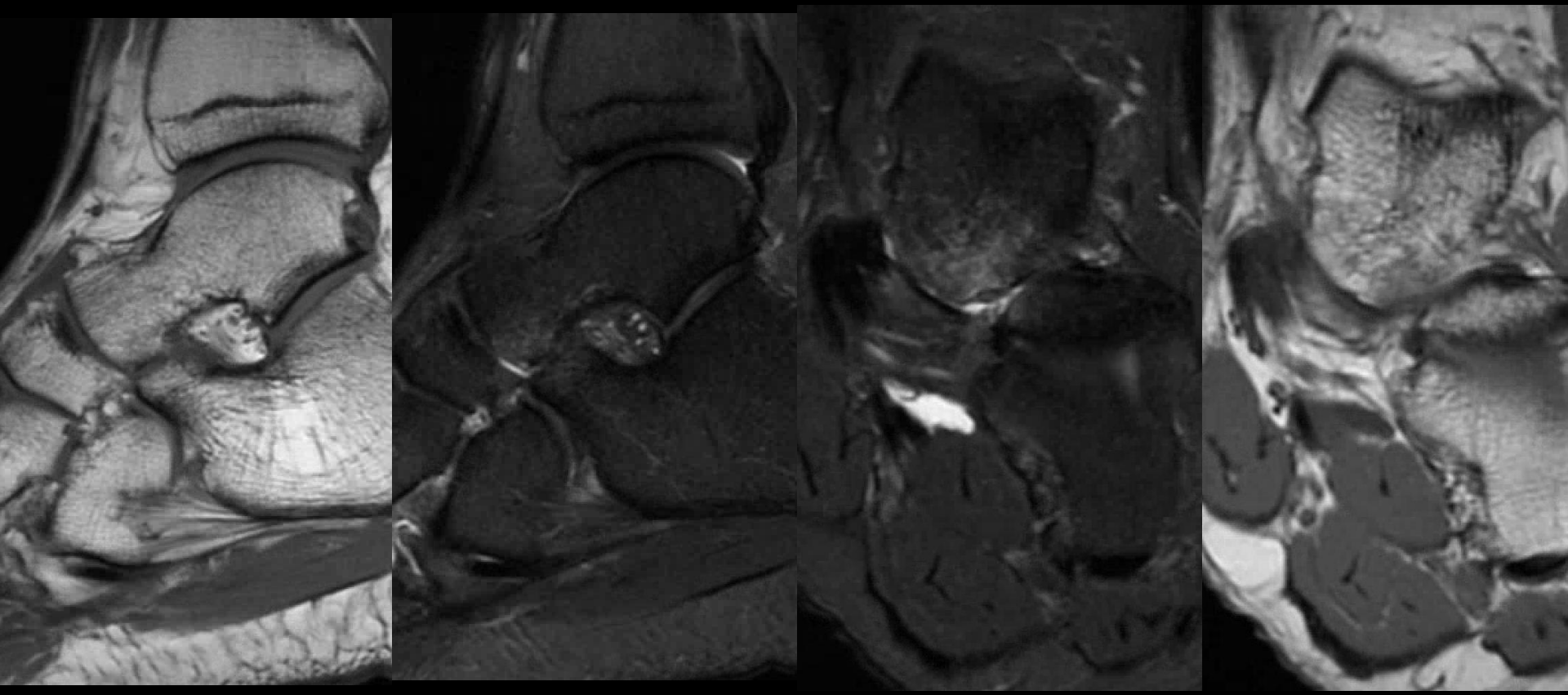


The Talus: Congenital Anomalies

- Anterior facet talocalcaneal coalition
  - Rare
  - Anterior process of the calcaneus and anterior facet of the talus

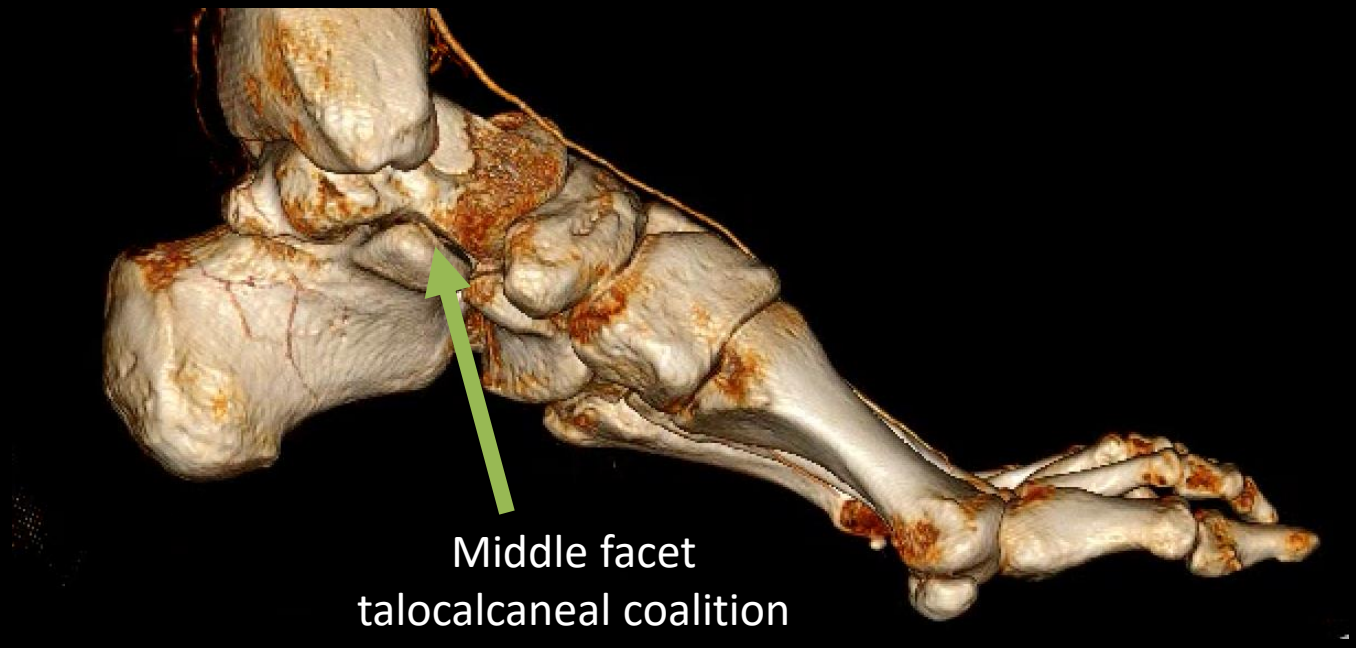
Anterior facet talocalcaneal coalition

30 year old male. Left ankle pain. Multiple sprains previously.
Painful medial, lateral talus, and anterior process of the calcaneus.



The Talus: Congenital Anomalies

- Talus Coalition:



The Talus: Congenital Anomalies

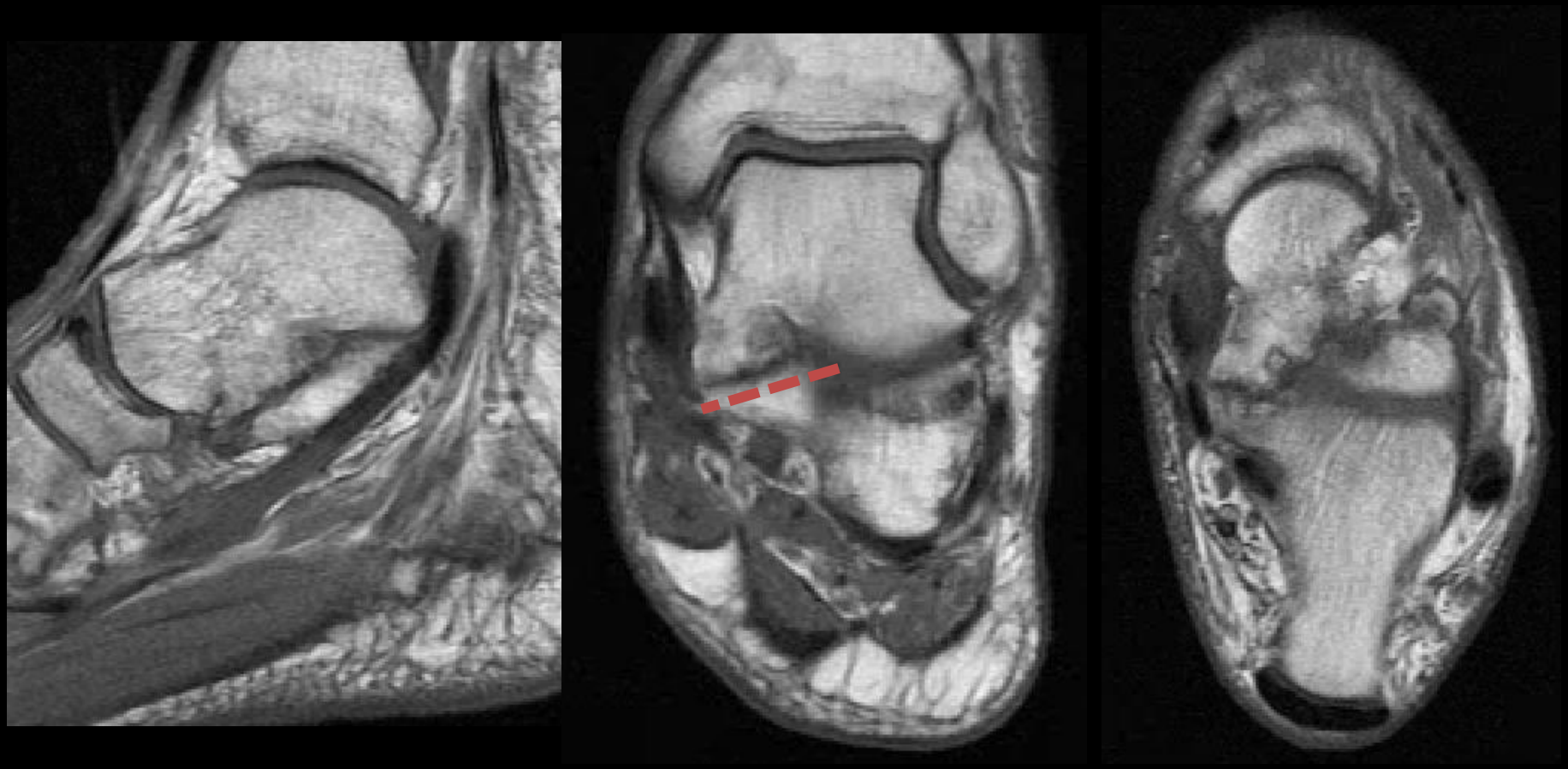
- Middle facet talocalcaneal coalition
  - Most common TCC
  - C-sign
  - Talar beak
  - Typical downward medial sloping seen on coronal MR
  - Hypoplastic or aplastic sustentaculum tali may also be present

Middle facet talocalcaneal coalition

13 y/o male. Ankle pain.

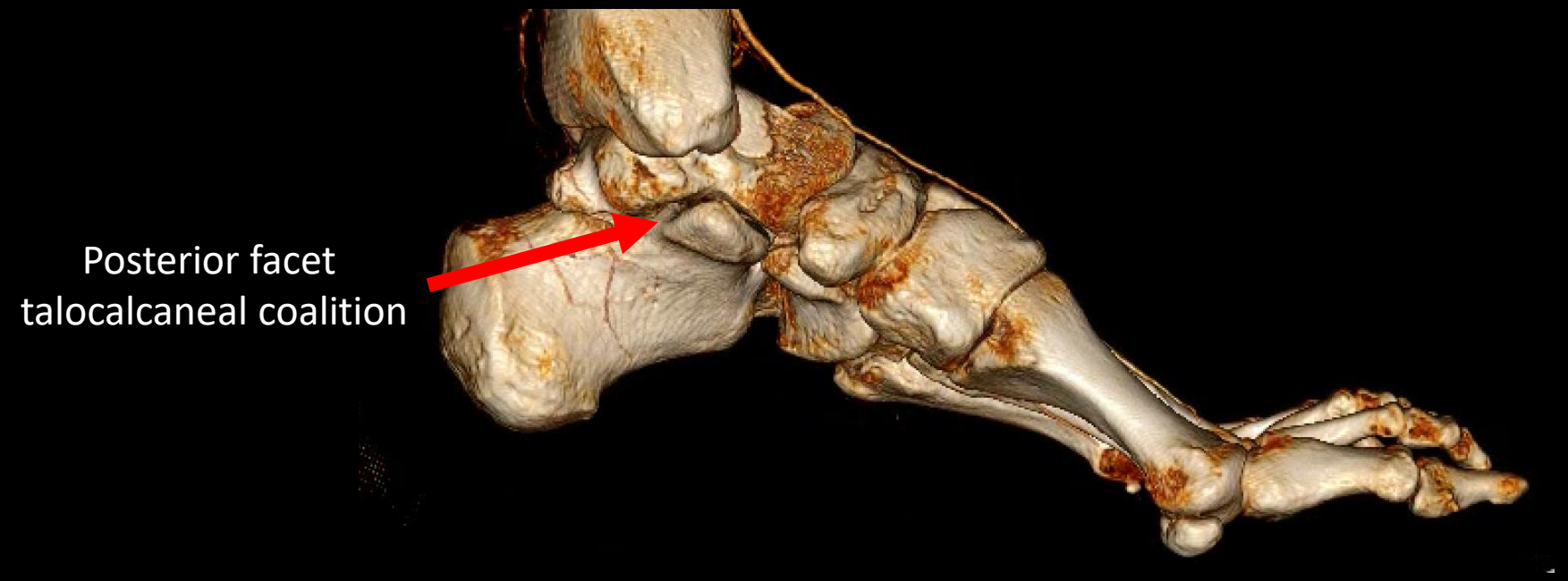
Middle facet talocalcaneal coalition

61 y/o male. Ankle pain.



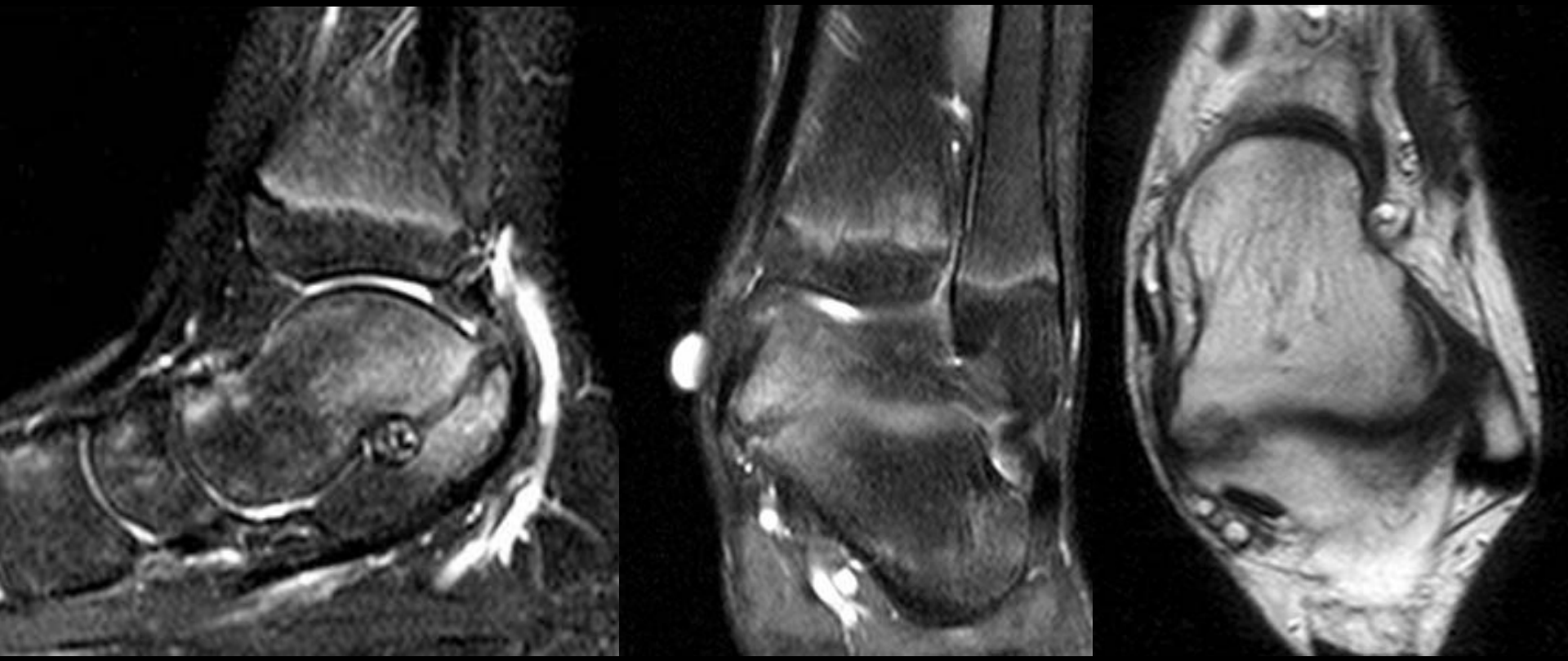
The Talus: Congenital Anomalies

- Talus Coalition:



Posterior facet talocalcaneal coalition

12 yo female presents with a history of medial pain



Burdett, Tarsal Coalition, Radsource

Posterior facet talocalcaneal coalition

48-year-old female with 3 months of worsening left heel pain. No preceding accident or injury.

Moe et al. AJR:186, January 2006

Normal (For Comparison)

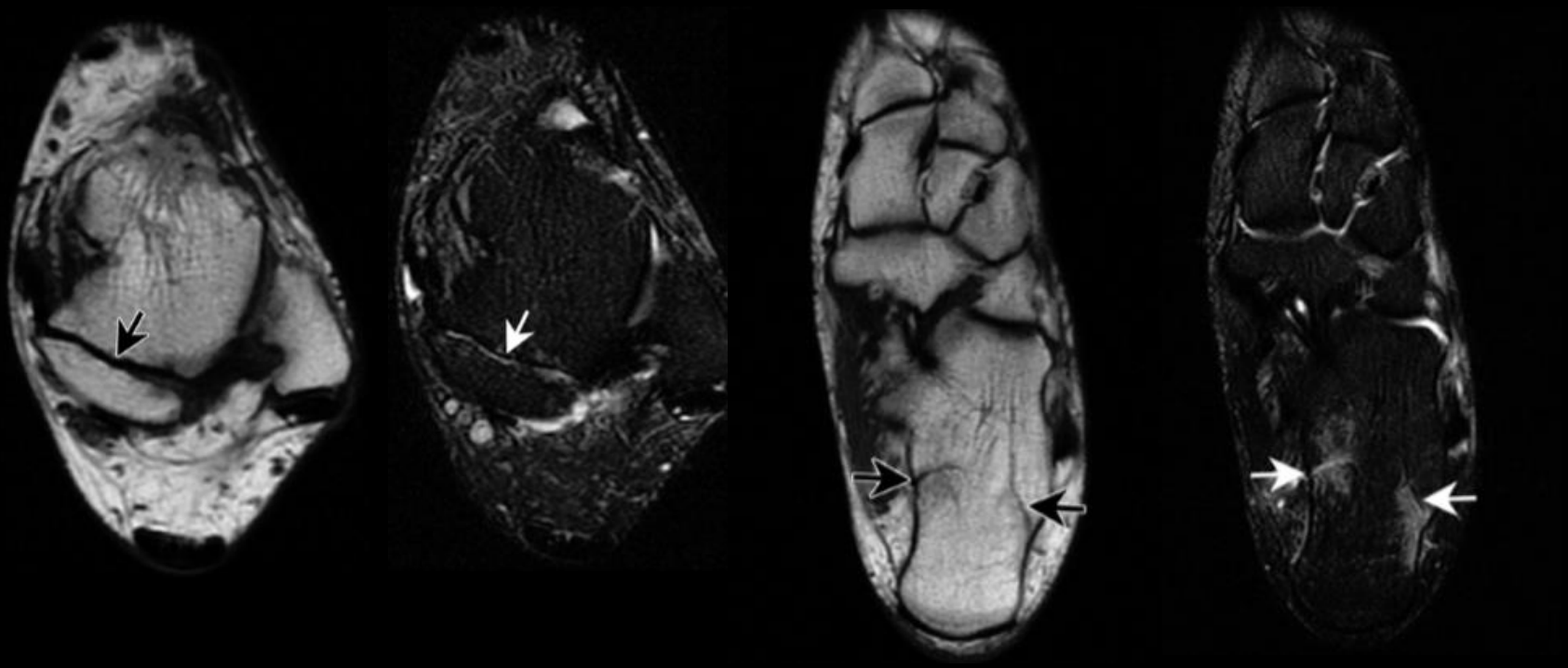
Posterior facet talocalcaneal coalition

48-year-old female with 3 months of worsening left heel pain. No preceding accident or injury.

Moe et al. AJR:186, January 2006

Posterior facet talocalcaneal coalition

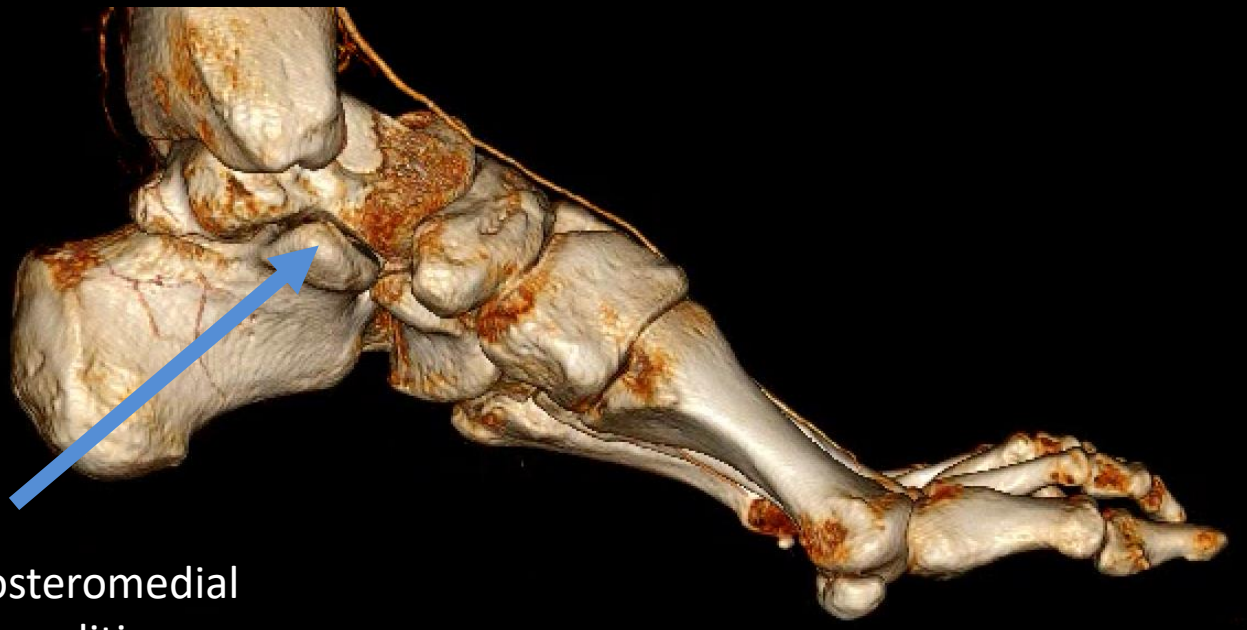
48-year-old female with 3 months of worsening left heel pain. No preceding accident or injury.



Moe et al. AJR:186, January 2006

The Talus: Congenital Anomalies

- Talus Coalition:



Extra-articular posteromedial talocalcaneal coalition

The Talus: Congenital Anomalies

- Extra-articular posteromedial talocalcaneal coalition:
  - Described by Harris in 1955
  - Linklater et. al. suggested that EATCC is usually a fibrous coalition
  - Asymptomatic or minimally symptomatic adult patients
  - Accompanied by various bony deformities or relatively normal subtalar joint

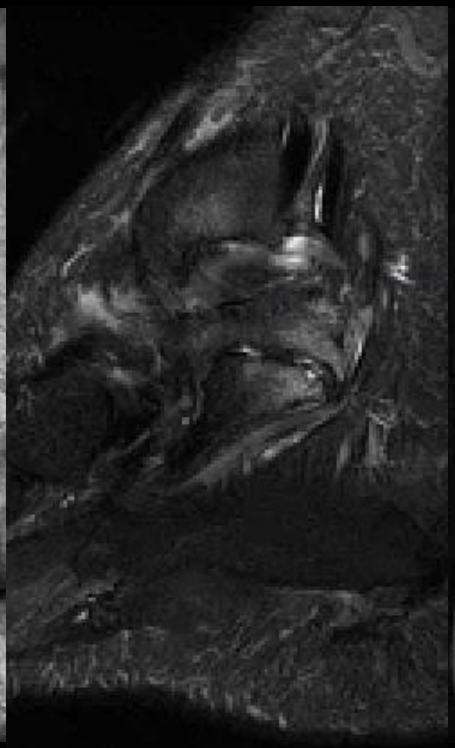
The posterior sustentaculumtali is a ridge of bone posterior to the middle subtalar joint and medial to the posterior subtalar joint

Petchprapa, et al

Extra-articular posteromedial talocalcaneal coalition

52 y/o male ankle pain. No injury






The Talus: Congenital Anomalies

- Extra-articular posteromedial talocalcaneal coalition:
  - Bixby, et al: 138 patients

Table 1 Location of coalition with respect to posterior facet, posteromedial sustentaculum and middle facet, and number of osseous coalitions at each site

Type of coalition	# of coalitions (%)	# of osseous coalitions (%)
Middle facet	97 (70.2)	33 (34)
Posterior facet	2 (1.4)	0 (0)
Posteromedial subtalar	39 (28.2)	0 (0)
Total	138 (100)	33 (23.9)

Pediatr Radiol (2016) 46:1142–1149

The Talus: Congenital Anomalies

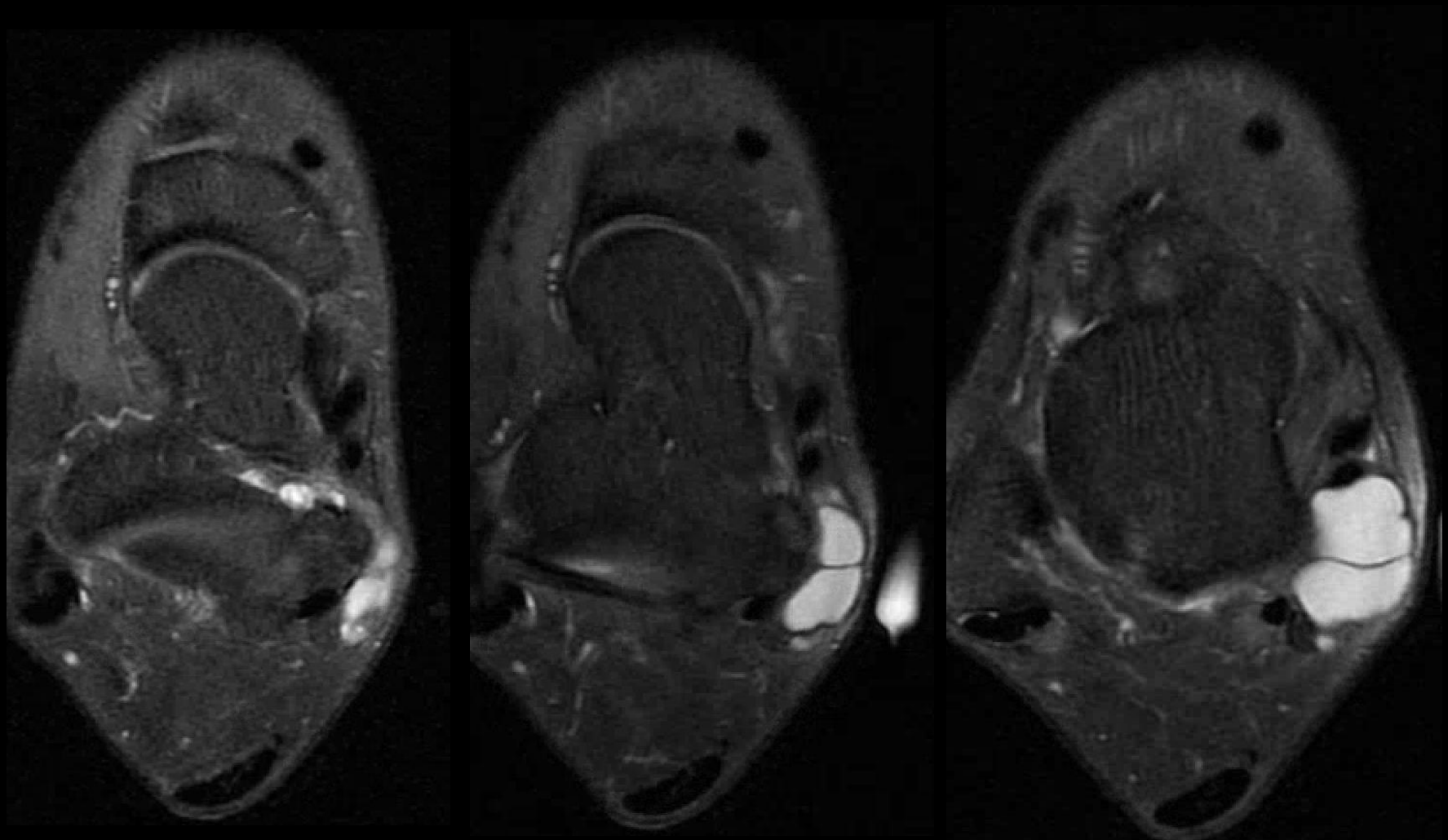
- Extra-articular posteromedial talocalcaneal coalition:
  - EATCC can result in tarsal tunnel syndrome:
    - Direct pressure by the bony protrusion on the tarsal tunnel structures
    - Secondary to ganglion cysts arising from the coalition and decompressing into the tarsal tunnel

Extra-articular posteromedial talocalcaneal coalition

25 y/o female. Medial ankle mass status post injury 1 year ago causing pain and numbness.

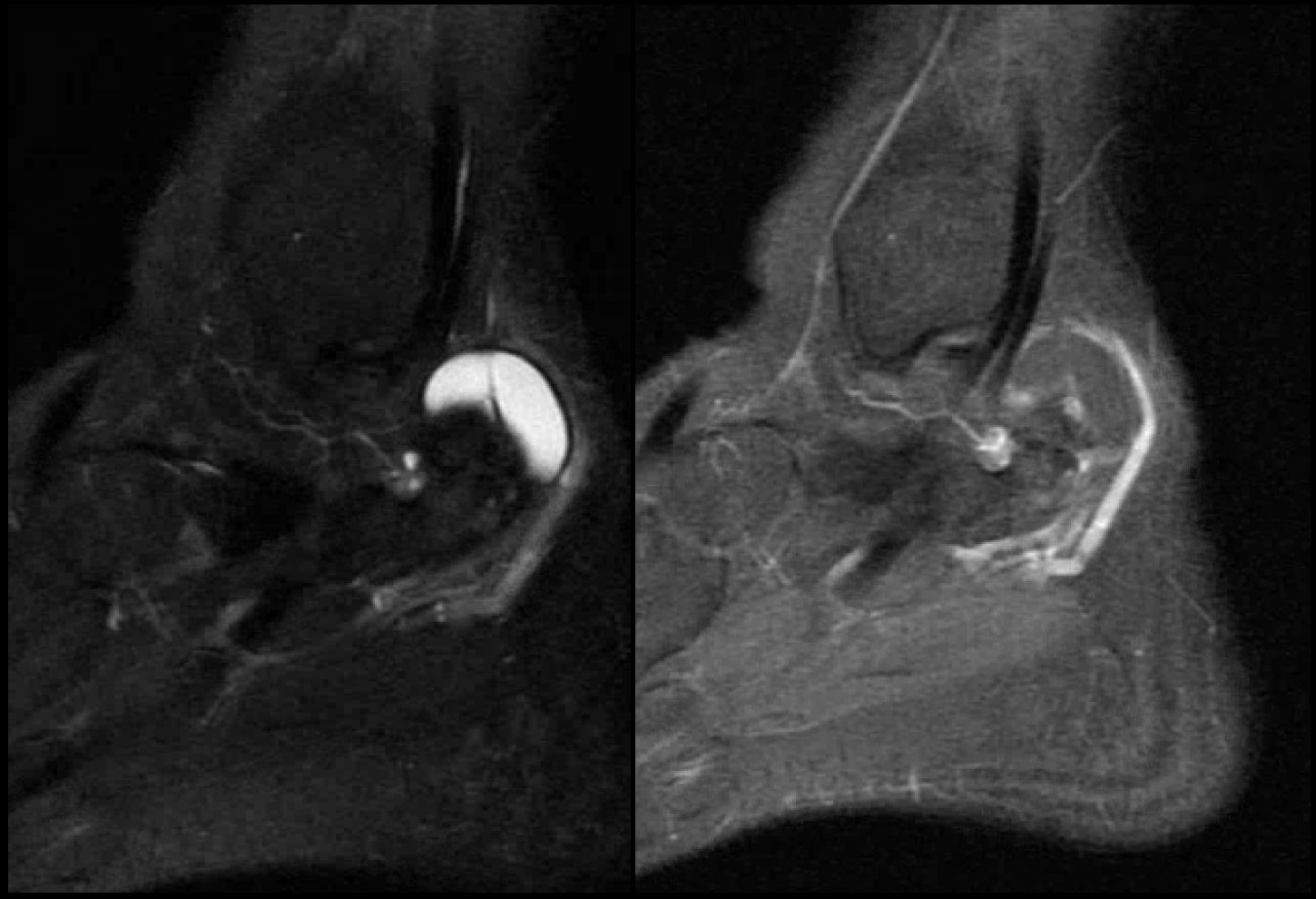
Extra-articular posteromedial talocalcaneal coalition

25 y/o female. Medial ankle mass status post injury 1 year ago causing pain and numbness.

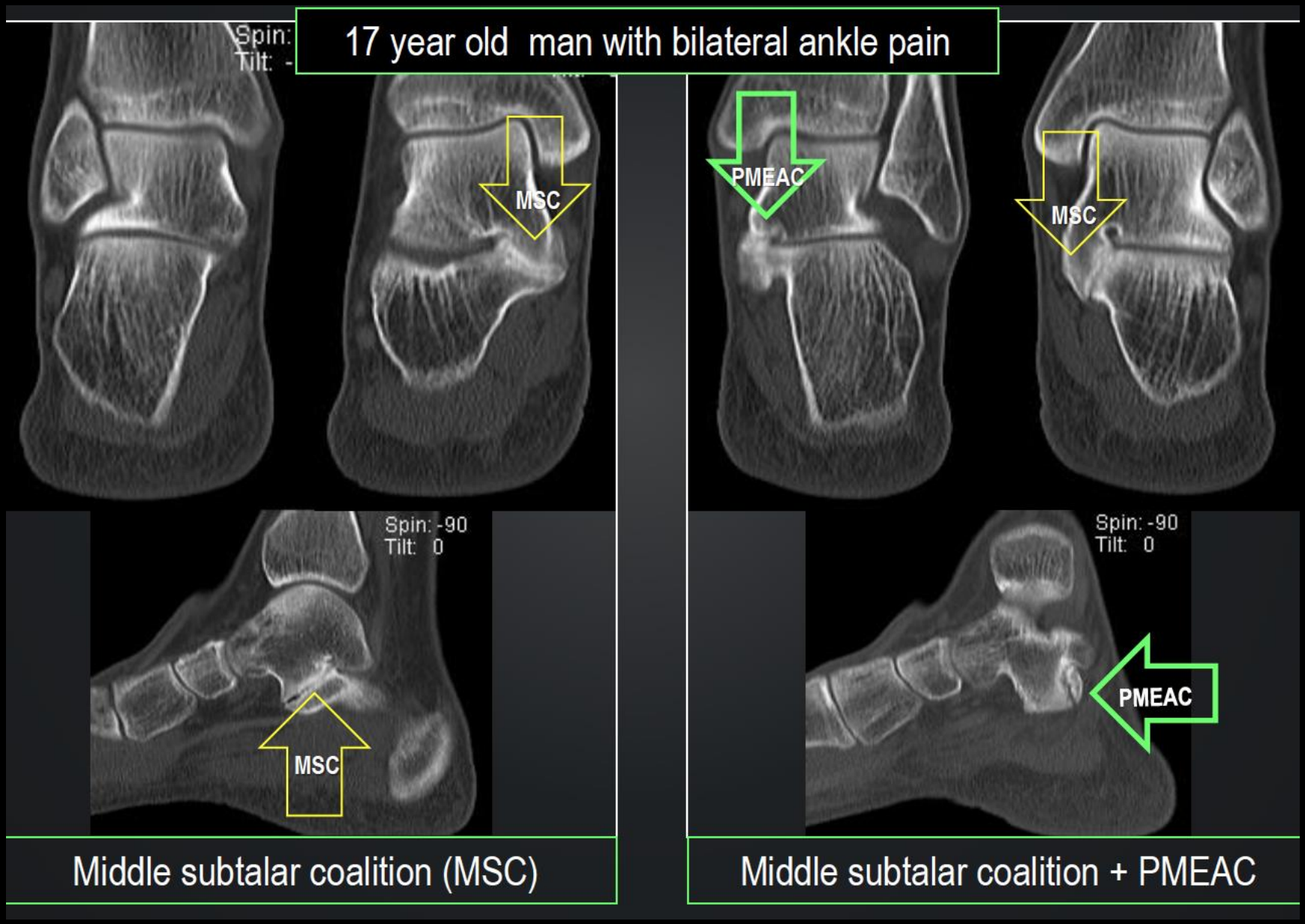


Extra-articular posteromedial talocalcaneal coalition

25 y/o female. Medial ankle mass status post injury 1 year ago causing pain and numbness.



Petchprapa, et al



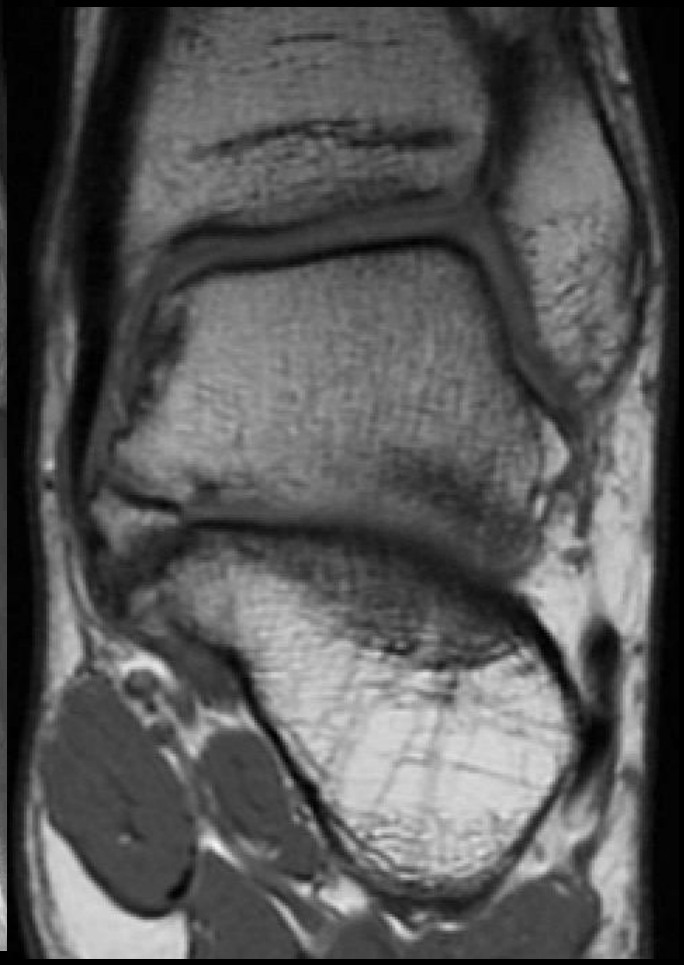
Petchprapa, et al

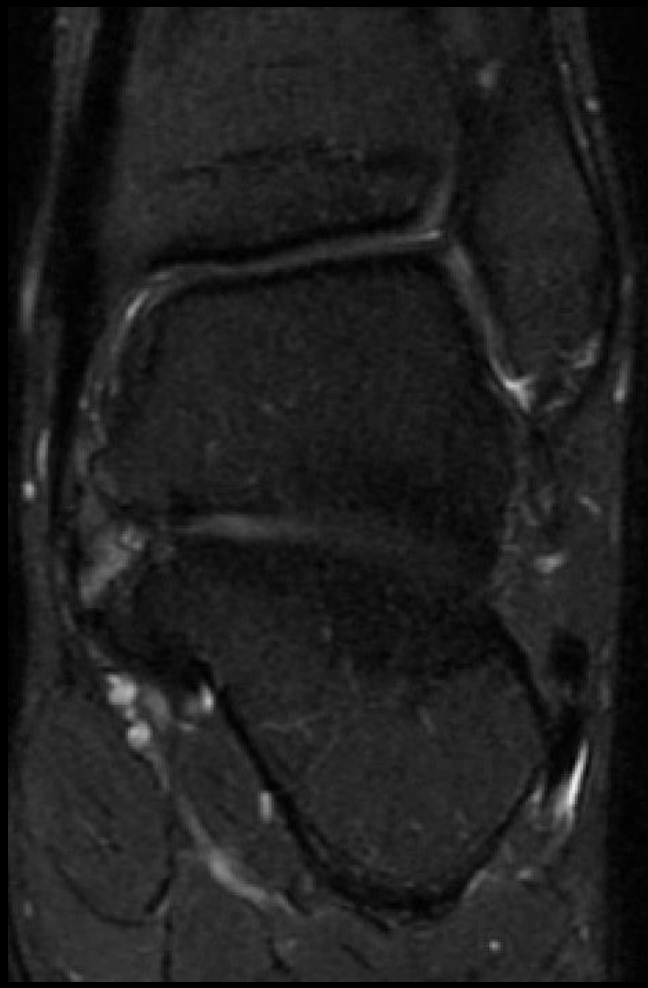
The Talus: Congenital Anomalies

- Os sustentaculum:
  - First described by Pfitzner in 1896
  - Small accessory bone lodged at the medial and posterosuperior aspects of the sustentaculum tali inferomedial aspect of the medial talar tubercle
  - Rare: 0.3–0.4%
  - Component of a type of extraarticular talocalcaneal coalition

Os sustentaculum

30 year old male. Left ankle pain. Multiple sprains previously.
Painful medial, lateral talus, and anterior process of the calcaneus.

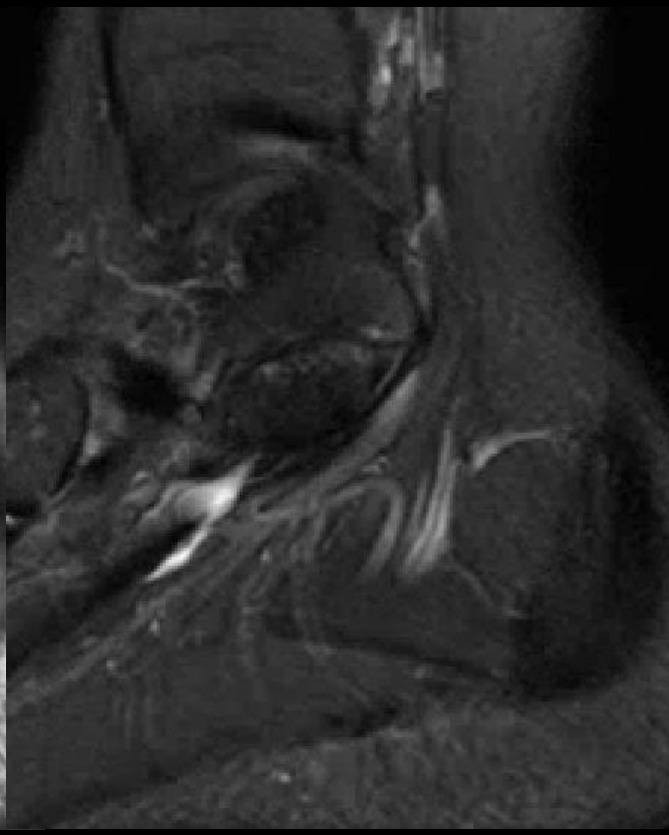




Os sustentaculum

30 year old male. Left ankle pain. Multiple sprains previously.
Painful medial, lateral talus, and anterior process of the calcaneus.



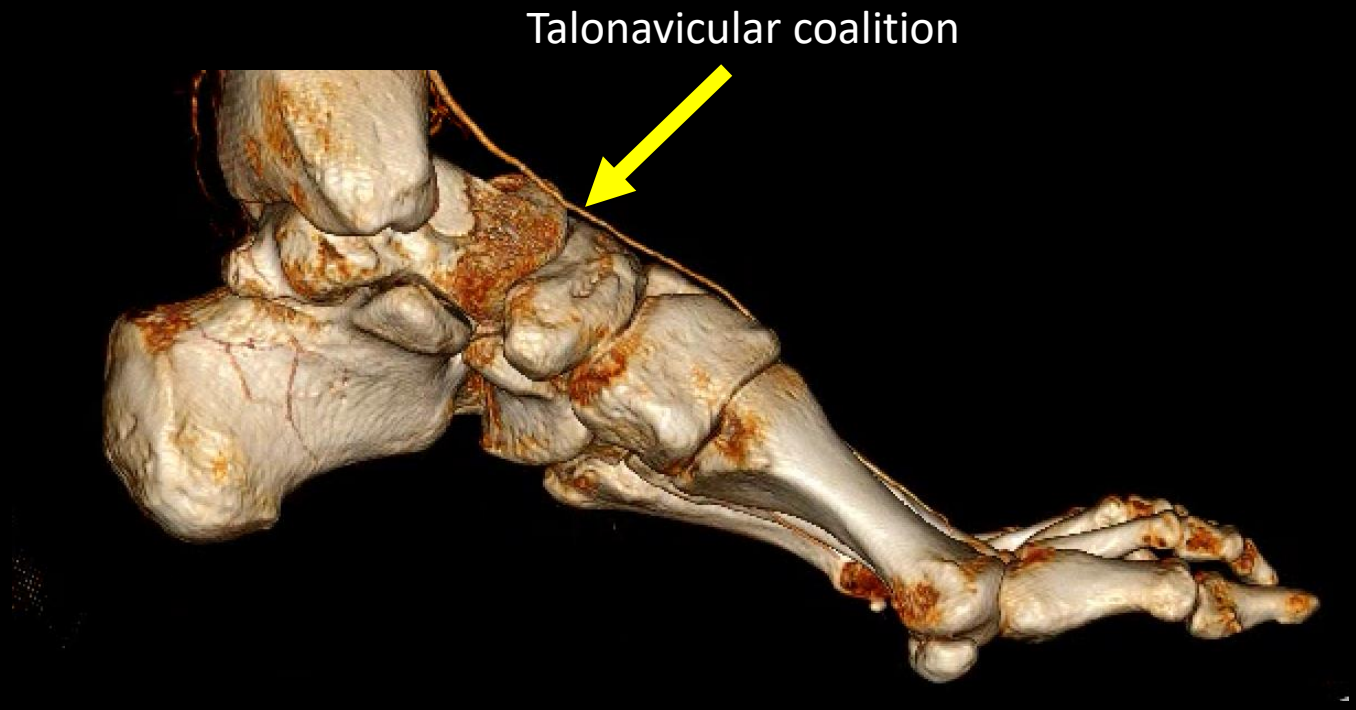


Os sustentaculum

68 year old male. Recent fleck from France. Left leg pain since then.

The Talus: Congenital Anomalies

- Talus Coalition:



The Talus: Congenital Anomalies

- Talonavicular coalition:
  - Rare
  - Uni or bilateral
  - Associations:
    - Symphalangism
    - Clinodactyly
    - Great toe that is shorter than the second toe
    - Pes cavus
    - Calcaneonavicular coalition
    - Talocalcaneal coalition
  - Mushroom sign (AP)
  - Loss of the talar-scaphoid joint line at the level of Chopart's joint (Lateral)

Talonavicular coalition

35-year-old male. Bilateral ankle pain. No preceding accident or injury.

Talonavicular Coalition Macera et al. 2017

Talonavicular coalition

Case courtesy of Karine Morche, Radiopaedia.org, rID: 68160

The Talus: Congenital Anomalies

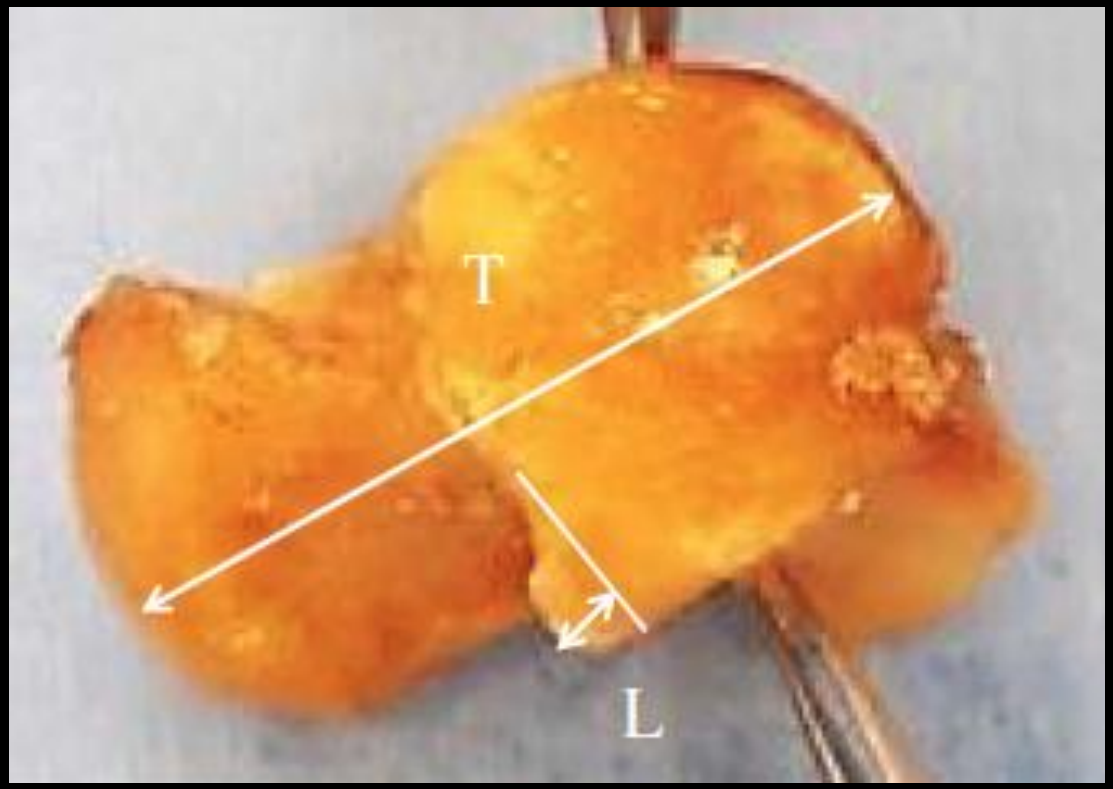
- Accessory Anterolateral Talar Facet
  - First described by Sewell in 1904
  - Previously known as "facies externa accessoria corporis tali"
  - Squaring or broadening of the apex of the lateral aspect of the talus

The Talus: Congenital Anomalies

- Accessory Anterolateral Talar Facet
  - One of the causes of a painful rigid flat foot
  - Other more recognized and established causes of flat foot:
    - Tarsal coalition
    - Hindfoot valgus
    - Infectious
    - Inflammatory
    - Degenerative arthritides
    - Neoplastic or neurologic processes
    - Osteochondral fractures

The Talus: Congenital Anomalies

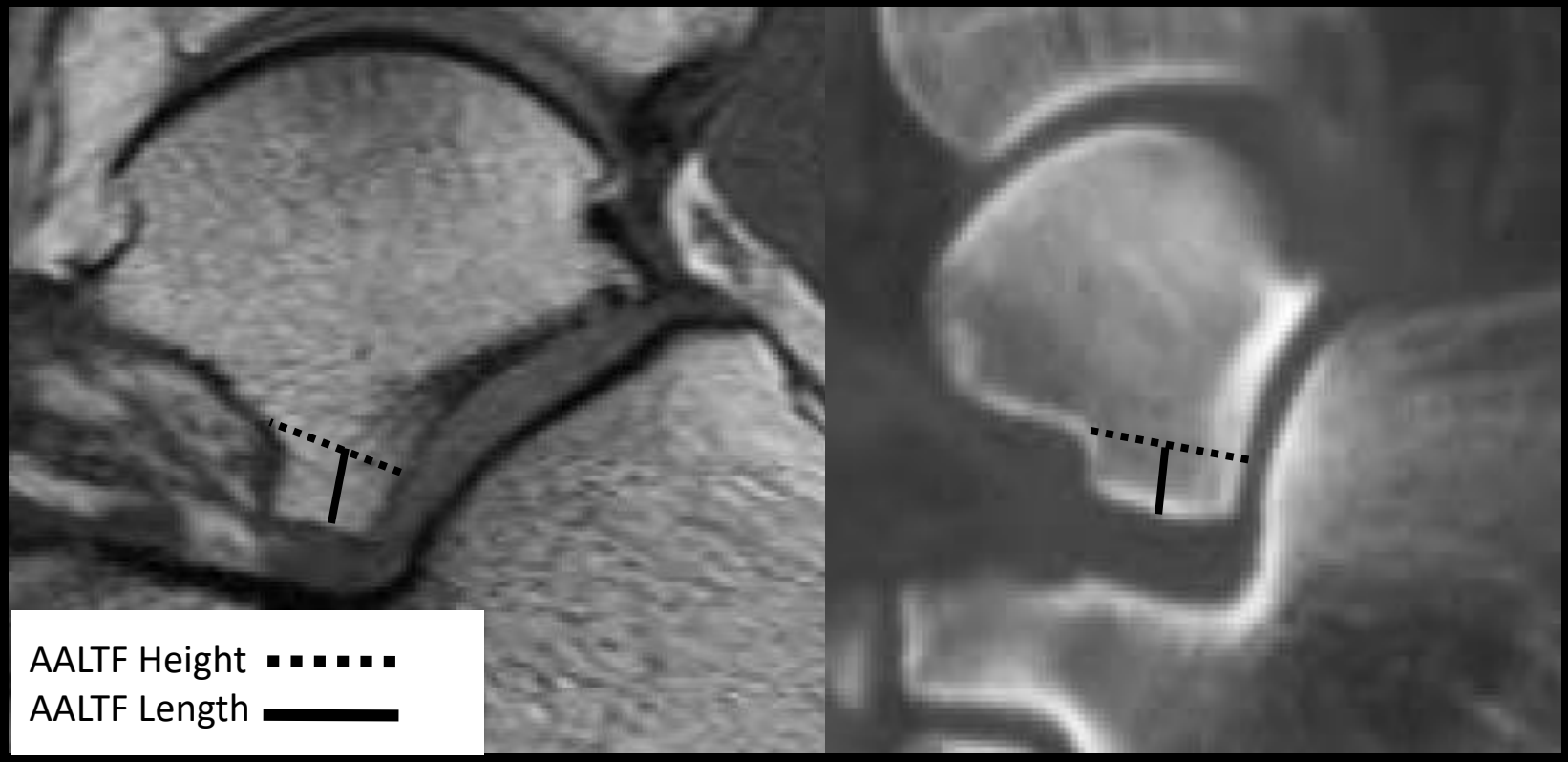
- Accessory Anterolateral Talar Facet



Hirano T, Niki H, Akiyama Y, Beppu M. Anatomical characteristics of the accessory antero-lateral talar facet. J Orthop Sci. 2015; 20(1):124-128.

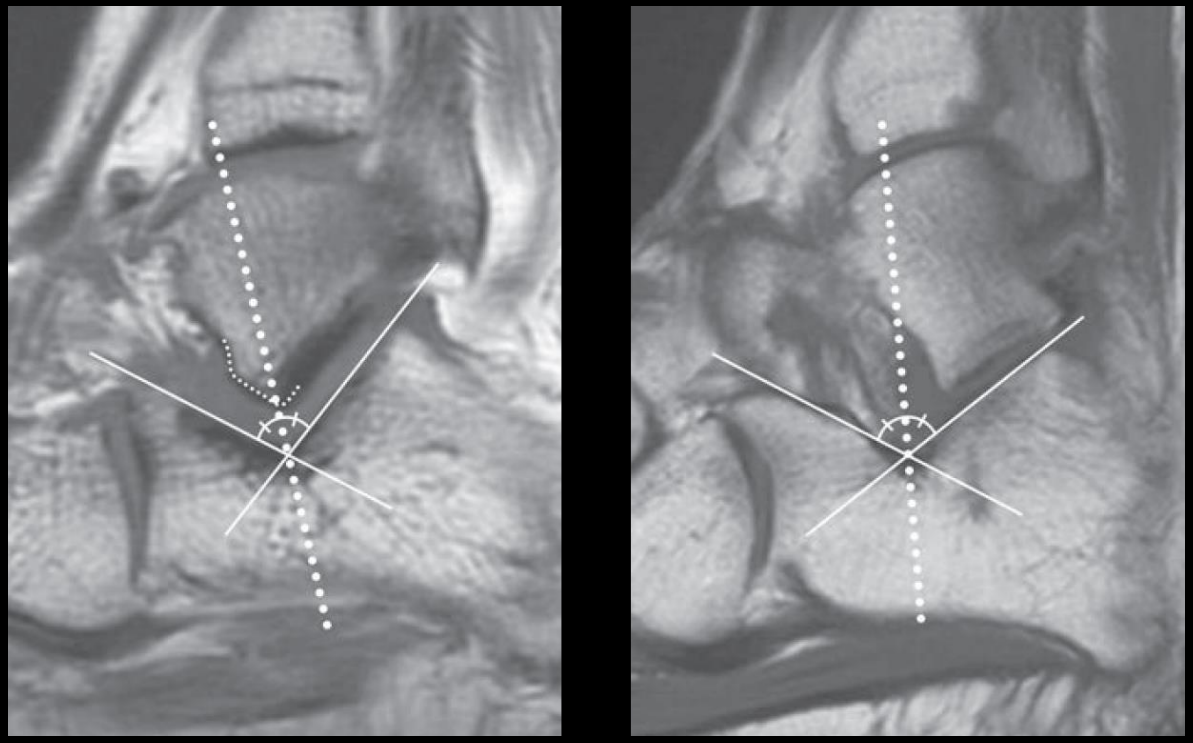
The Talus: Congenital Anomalies

- Accessory Anterolateral Talar Facet



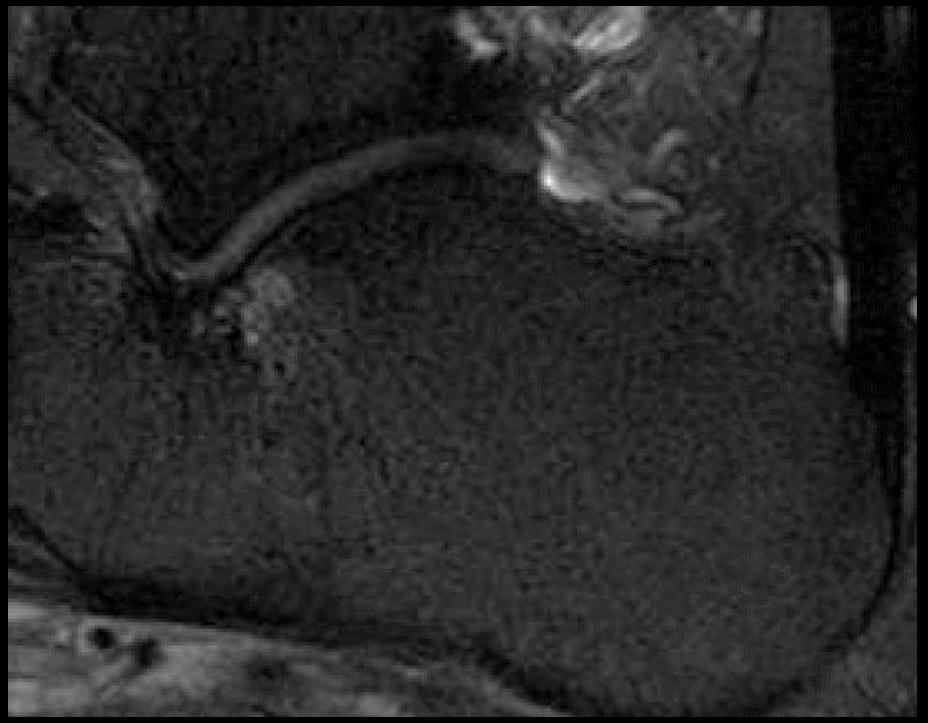
The Talus: Congenital Anomalies

- Accessory Anterolateral Talar Facet

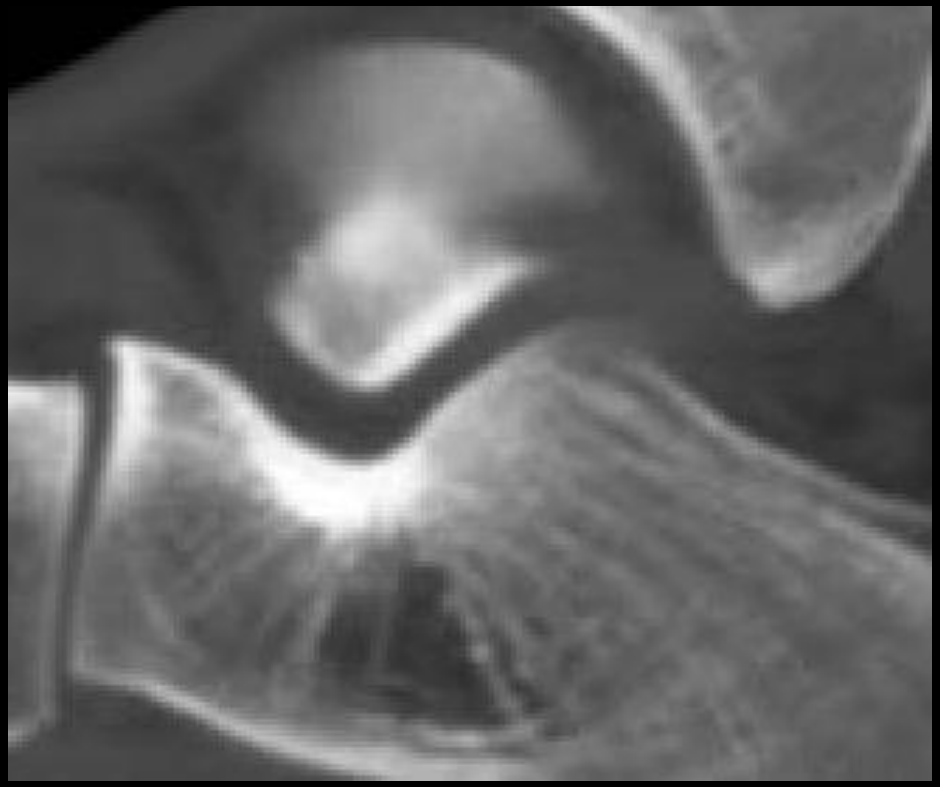


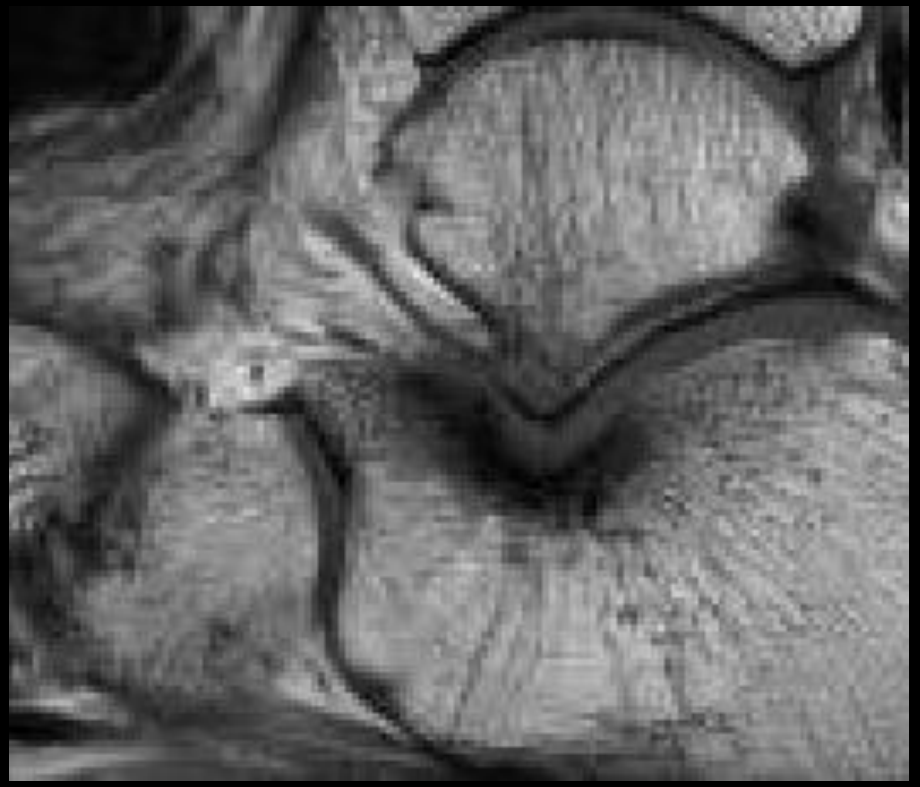
AJR:207, October 2016

AALTF Osseous Findings

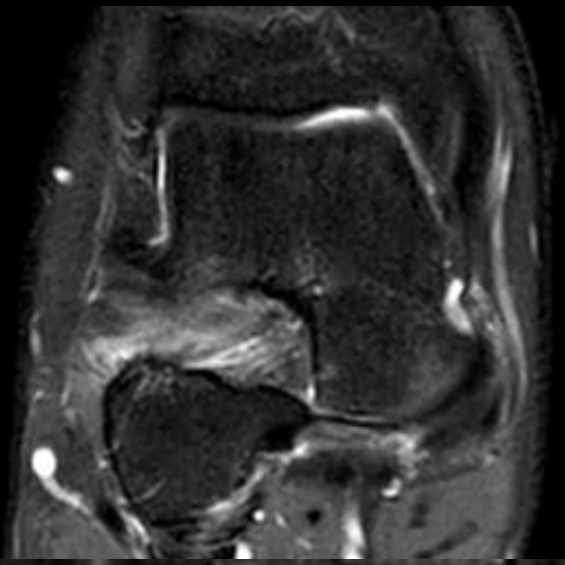


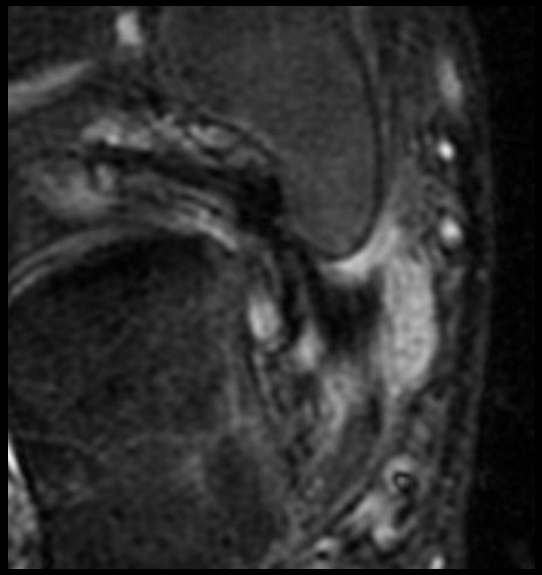
AALTF Osseous Findings

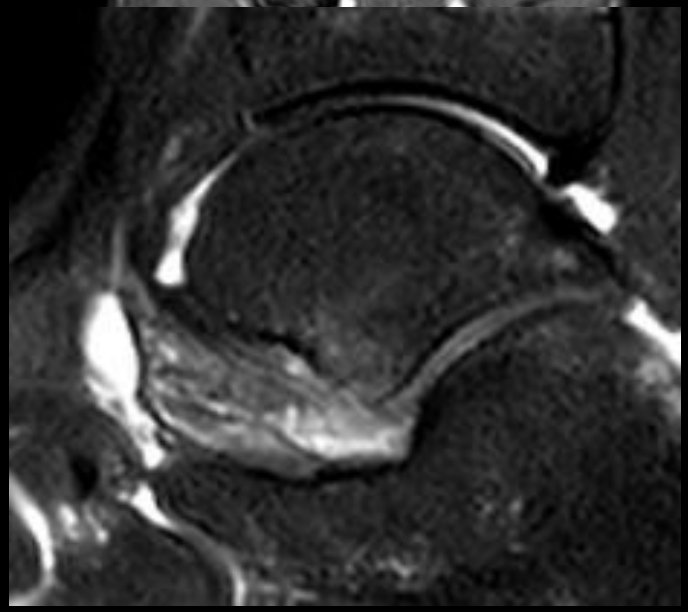




AALTF Soft Tissues Findings







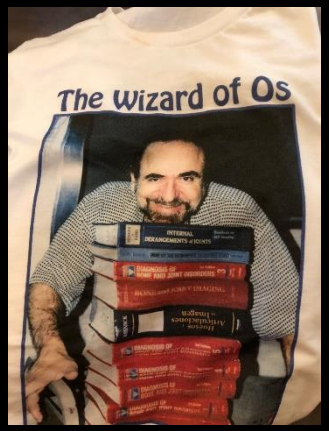
The Talus: Congenital Anomalies

- Accessory Anterolateral Talar Facet:
  - Prevalence initially reported by Sewell: only 10.2%
  - MR imaging prevalence of the AALTF:
    - 32.7% of symptomatic patients
    - 26.0% of asymptomatic volunteers
  - Two cadaveric studies by Martus et al. and Sarrafian in which an AALTF was seen in 34% of specimens in both studies

AJR:207, October 2016

The Talus: Congenital Anomalies

- Alqahtani et al, reported AALTF in 31.55% of 187 patients with sinus tarsi syndrome and/or tarsal coalition



The Talus: Congenital Anomalies

Table 1 Demographics and Imaging Characteristics of AALTF

	Total	AALTF	
	n (%)	n (%)	P-value
Total	187 (100.00)	59 (31.55)	
Male	88 (47.10)	36 (40.91)	
Female	99 (52.90)	23 (23.23)	
Side			
Right	95 (50.80)	31 (32.63)	>0.1
Left	92 (49.20)	28 (30.43)	>0.1
Modality			
MRI +/- CT	165 (88.24)	52 (31.15)	
CT only	22 (11.76)	7(31.82)	
Osseous changes			
Calcaneal bone marrow edema*	45(27.27)	36 (80.00)	<0.001
Talar bone marrow edema*	39 (23.64)	35 (89.74)	<0.001
Cortical thickening	36 (19.25)	34 (94.44)	<0.001
Cystic changes	35 (18.72)	24 (68.57)	<0.001
Subfibular soft tissue edema*	37 (22.42)	29 (78.38)	<0.001
Sinus tarsi edema*	117 (70.91)	45 (38.46)	0.014

*Bone marrow and soft tissue edema was only evaluated on 165 patients who had MR imaging.

The Talus: Congenital Anomalies

Table 2 Frequency of Coalition and AALTF

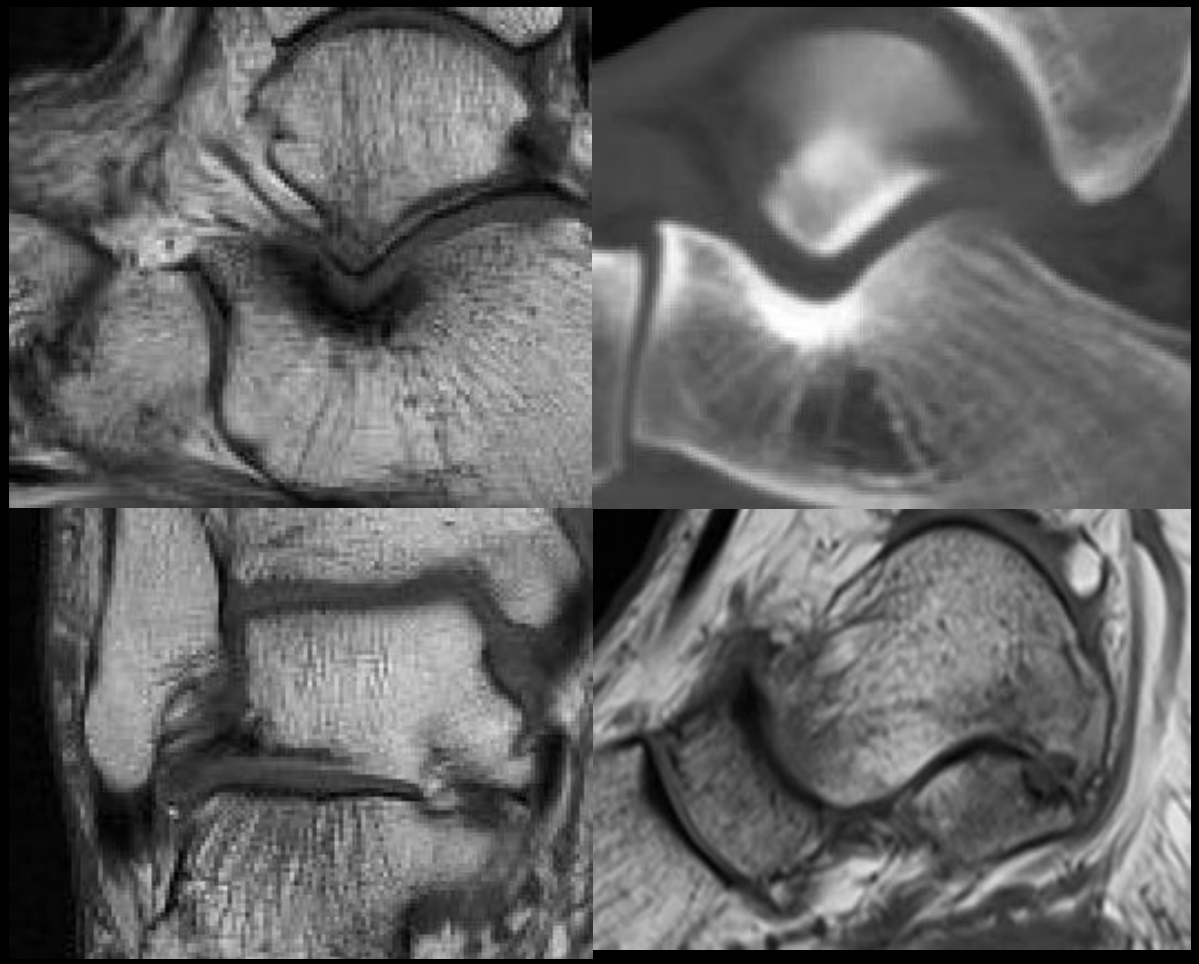
Tarsal coalition	Total	AALTF	
	n (%)	n (%)	P-value
Any coalition	70 (37.43%)	31 (44.29%)	0.005
CNC	37 (19.79%)	11 (29.73%)	0.478
MFTCC	9 (4.81%)	7 (77.78%)	0.005
PFTCC	5 (2.67%)	1 (20.00%)	>0.1
EATCC	25 (13.37%)	19 (76.00%)	<0.001
Other	6 (3.21%)	1 (16.67%)	0.901

* CNC= Calcaneonavicaular coalition, MFTCC= Middle facet talocalcaneal coalition, PFTCC= Posterior facet talocalcaneal coalition, EATCC= Extra-articular talocalcaneal coalition

Accessory Anterolateral Talar Facet

Accessory Anterolateral Talar Facet

Accessory Anterolateral Talar Facet

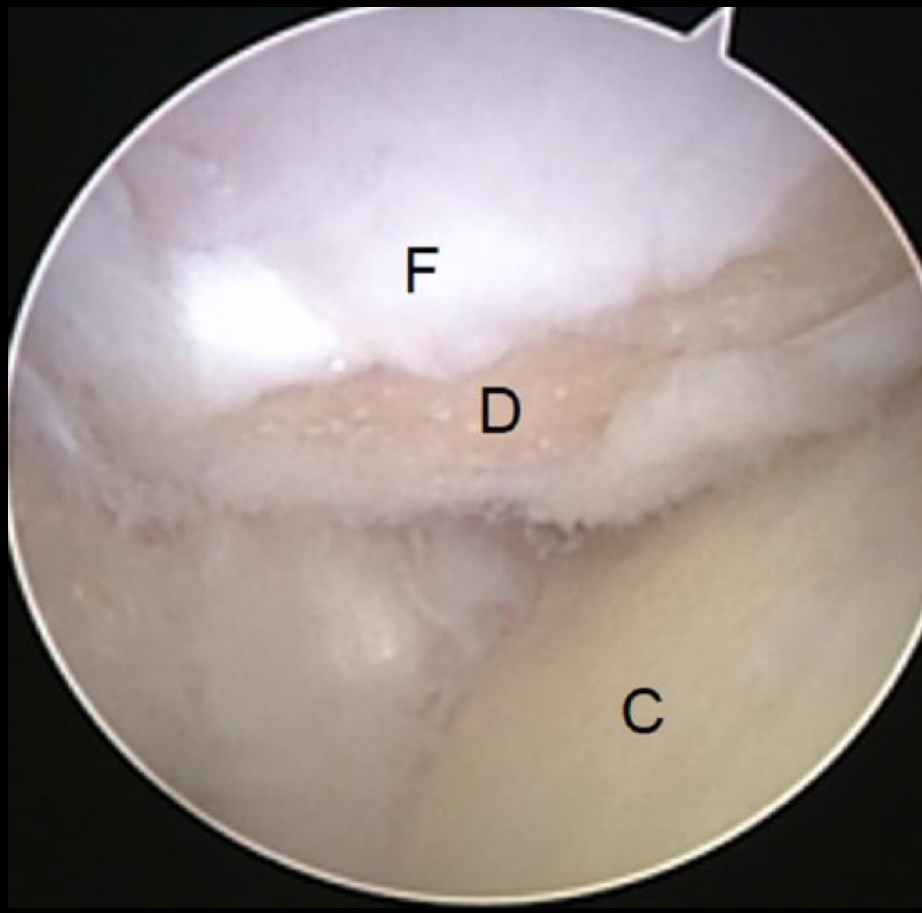


Article

Accessory Talar Facet Impingement in Pathologic Conditions of the Peritalar Region in Adults

Hisateru Niki, MD, PhD[1], Takaaki Hirano, MD, PhD[1], Yui Akiyama, MD, PhD[1], and Moroe Beppu, MD, PhD[1]

- 31 patients (aged 19-75 years) with persistent sinus tarsi pain
- Subjects underwent accessory facet resection with balancing reconstruction
- Arthroscopically,
  - 66% focal defect on the AALTF cartilage surface
  - 83% attenuation of the posterior capsular ligament



Niki, et al, Foot & Ankle International, 2014, Vol. 35(10) 1006–101

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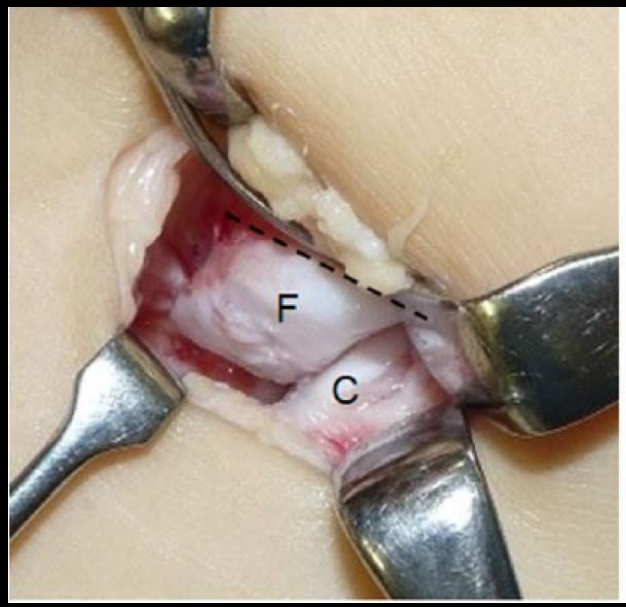

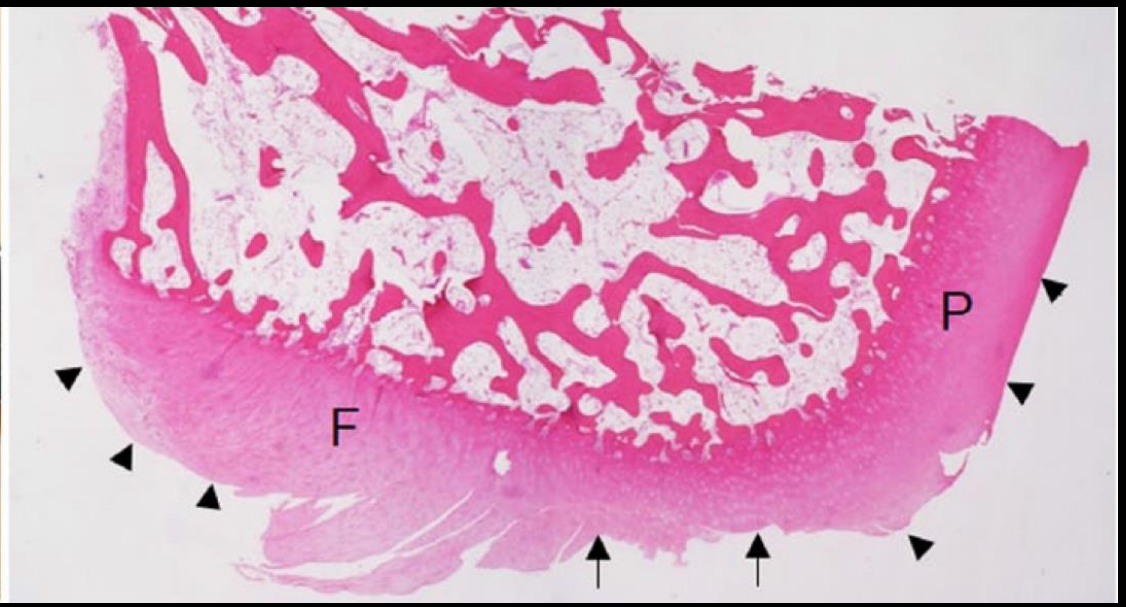

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- All x-ray parameters showed significant improvement postoperatively ($P < .001$)
- Mean objective scores improved from 54.0 preoperatively to 91.0 postoperatively ($P < .001$)
- Sinus tarsi pain and FABME were absent in all cases at the final follow-up

Niki, et al, Foot & Ankle International, 2014, Vol. 35(10) 1006–101

Article

Accessory Talar Facet Impingement in Pathologic Conditions of the Peritalar Region in Adults

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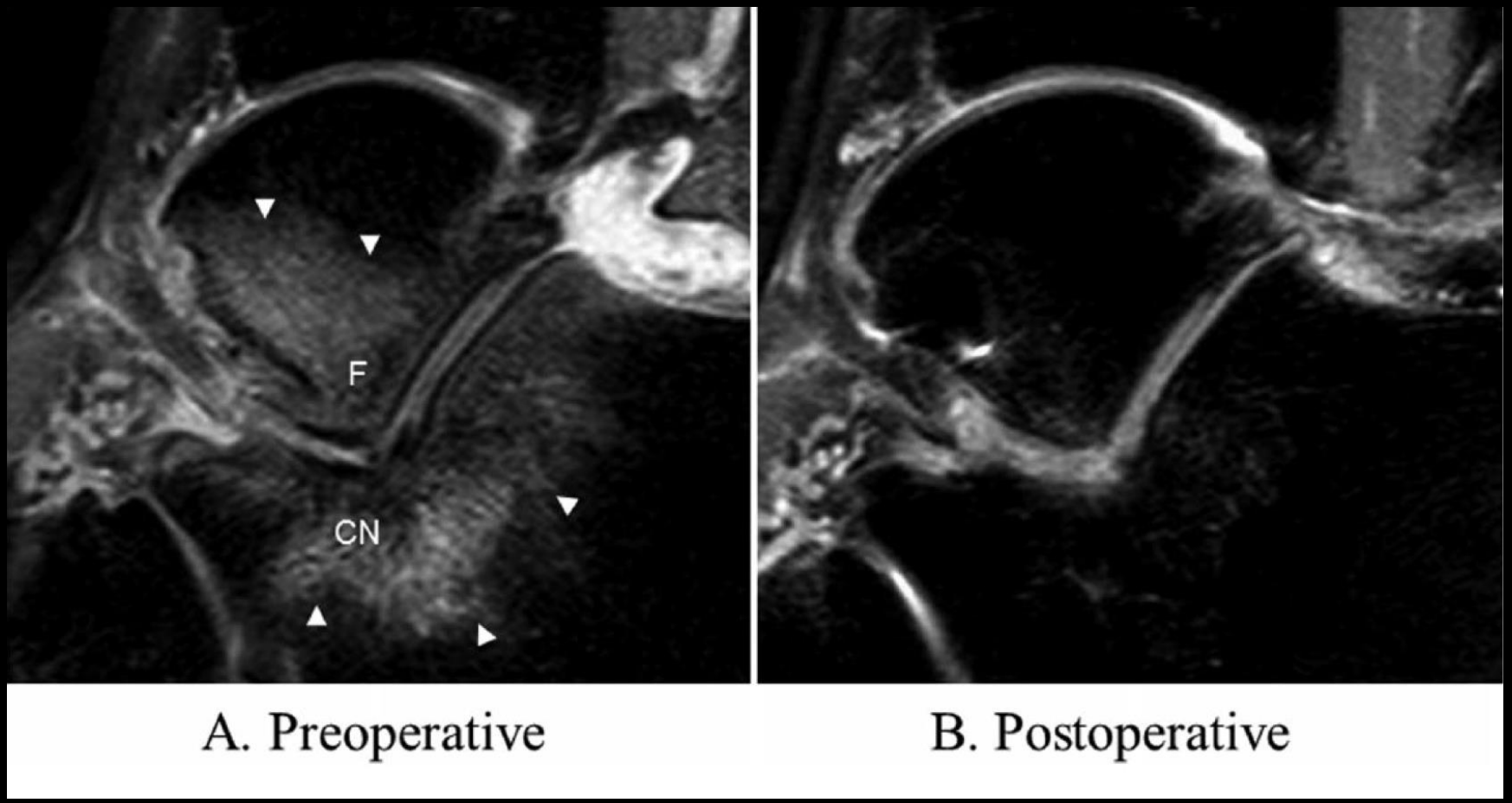
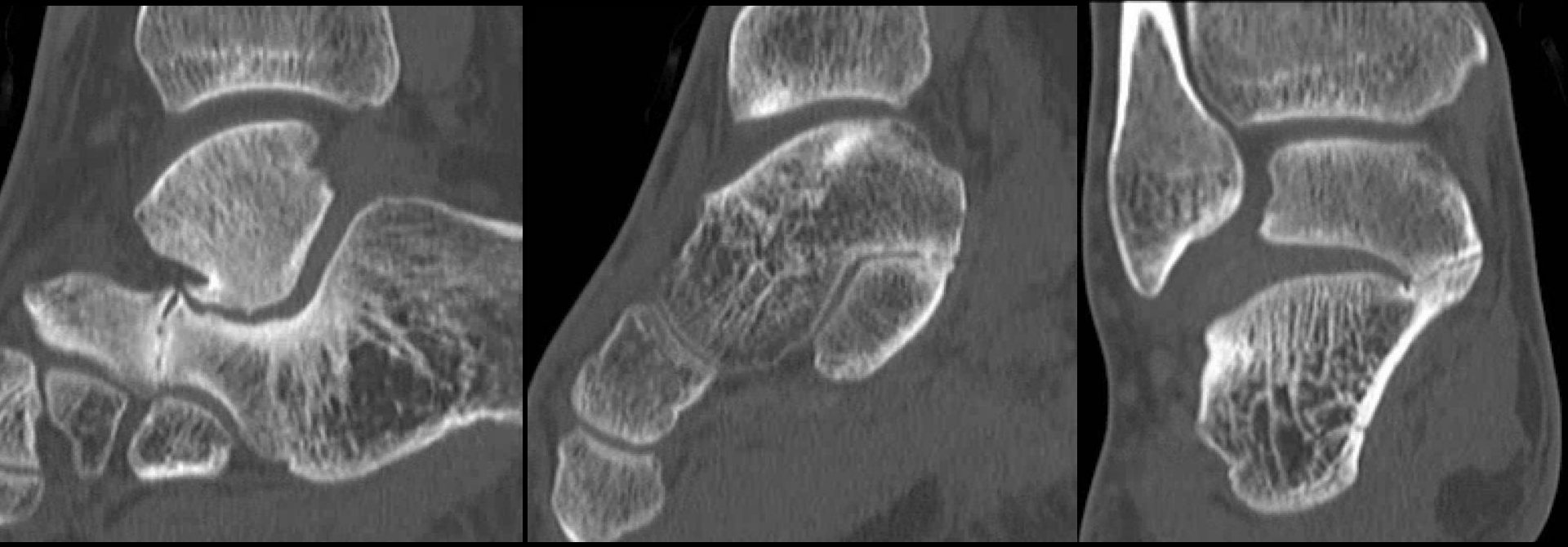


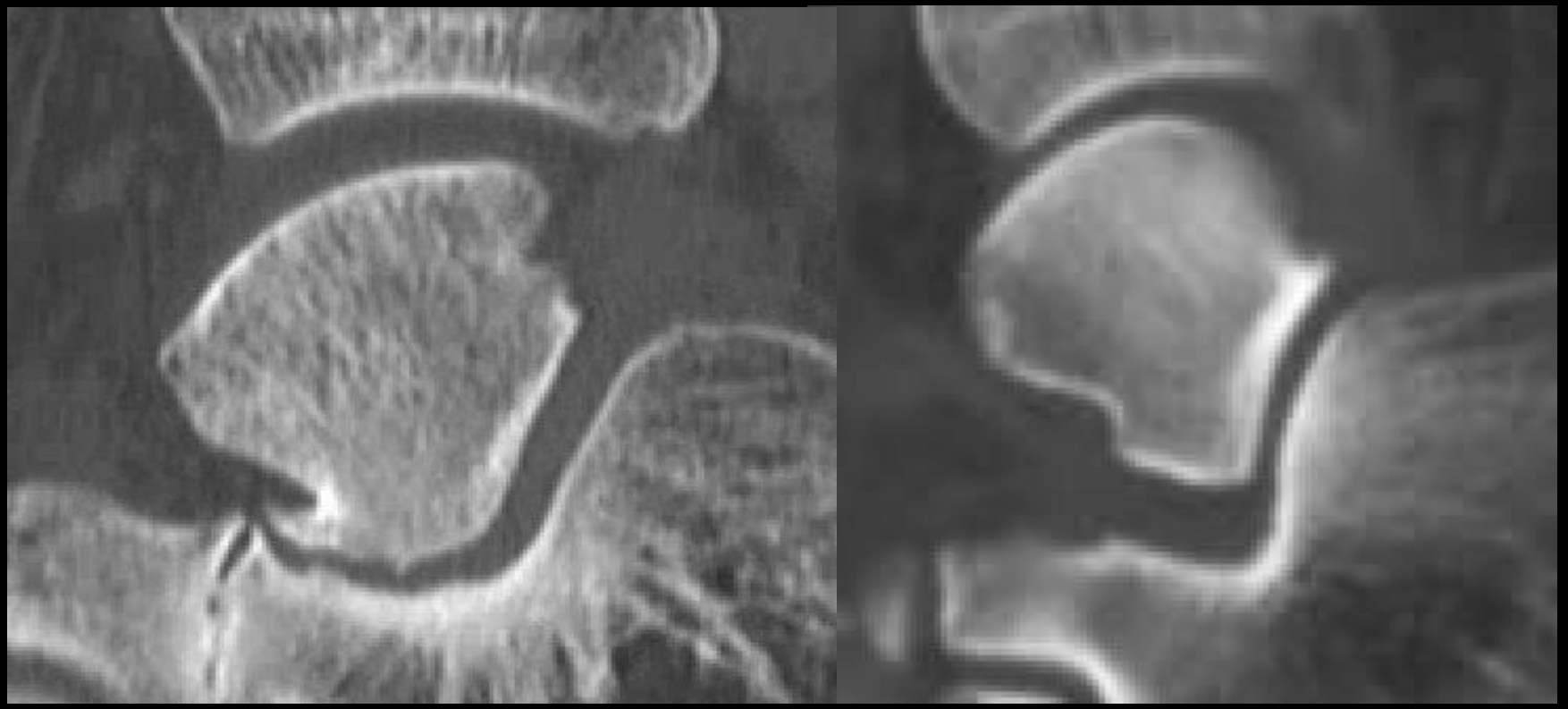
Niki, et al, Foot & Ankle International, 2014, Vol. 35(10) 1006–101

32 year old male. Ankle pain

32 year old male. Ankle pain

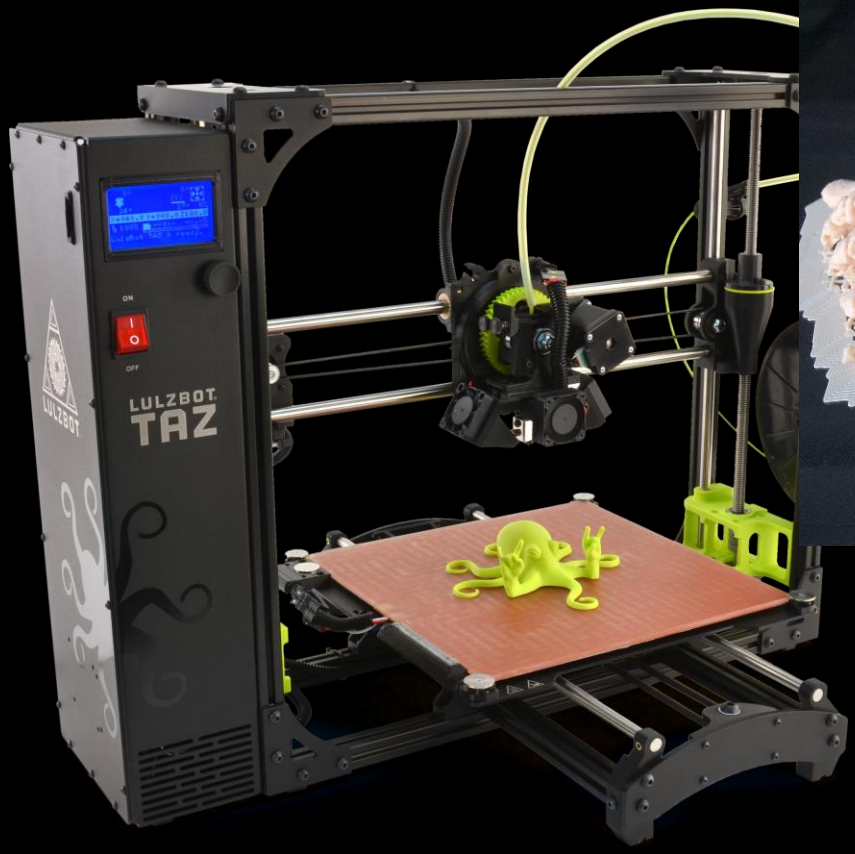


AALTF Acquired vs Congenital



The Talus

- Rady Children's Hospital 3D Printing Lab



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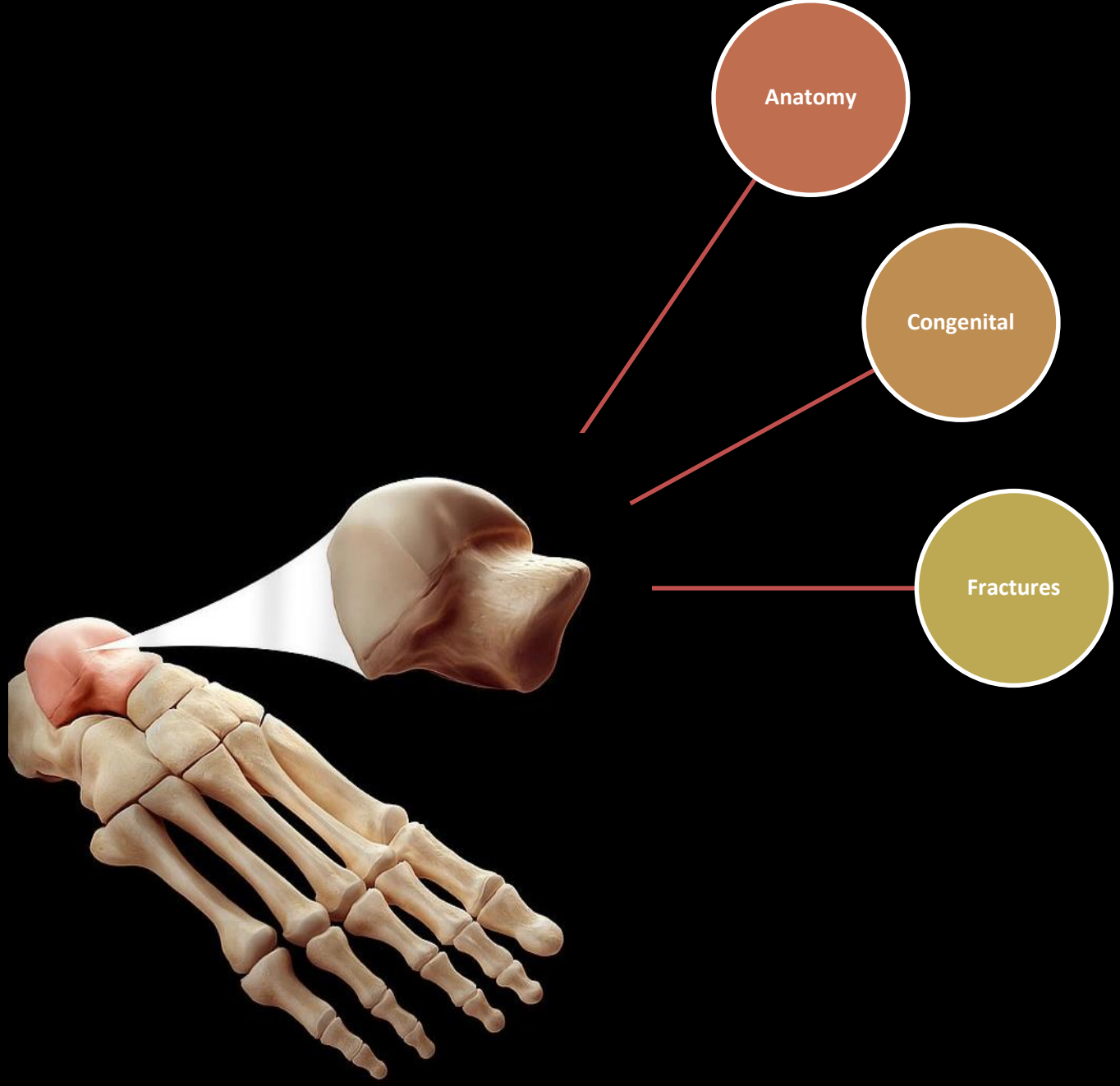
Dr. Jerry Dewek
Dr. Daniel Vincour


Anatomy
Congenital
Fractures

The Talus: Fractures

- Talar fractures represent *less than 1%* of all fractures in the human body
- 3% and 6% of fractures in the foot
- High-energy trauma
  - Talar head (5%), neck (50%), and body (23%) fractures
    - Posterior process fracture
    - Lateral process fracture
    - Talar dome injuries

The Talus: Fractures

- **Talar Head Fractures :**
  - Articular surface of the talus at the talonavicular articulation
  - Accompanied by dislocation or subluxation and adjacent bone fractures
  - 5%– 10% of all talar fractures
  - Pain at the dorsal midfoot, swelling and focal tenderness to palpation over the talar head, and painful range of motion

Mechanism:

- Crush injury to the articular surface
- Significant comminution
- Shear fracture

Talar head fracture

20 years old male, status post MVA

Melenevsky,, **RadioGraphics 2015**

Talar head fracture

20 years old male, status post MVA

The Talus: Fractures

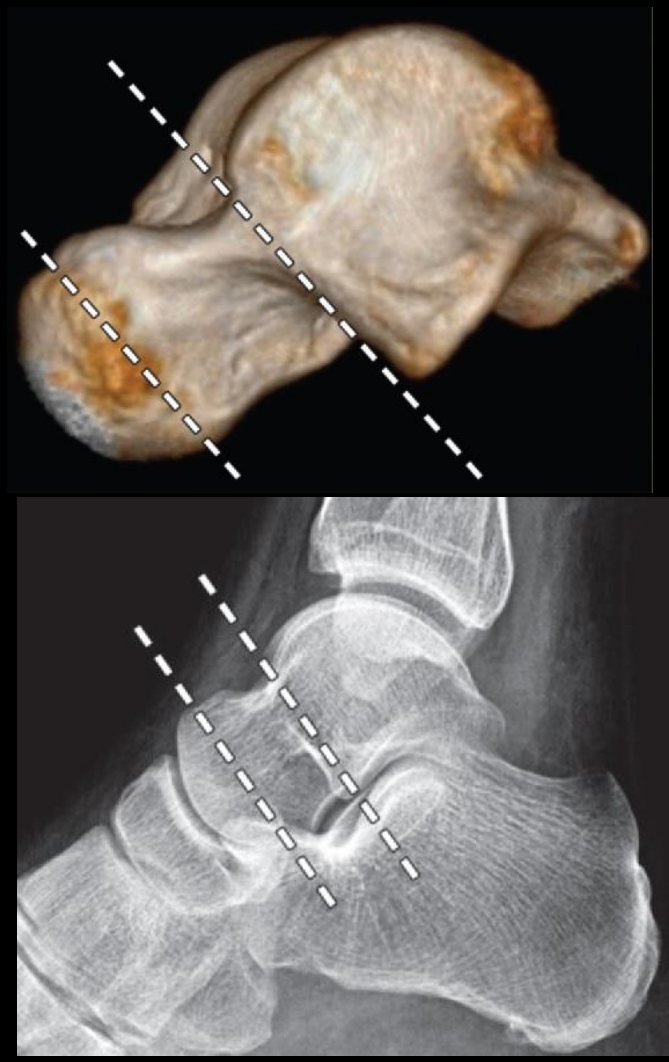
- **Talar Head Fractures :**
  - Imaging:
    - AP, oblique, and lateral radiographs of the foot
    - CT
  - Management:
    - Nondisplaced talar head fractures are treated conservatively
    - Displaced fractures require surgical intervention
  - Goal:
    - Maintain congruity of the talonavicular joint
    - Reduce the incidence of subsequent osteoarthritis and avascular necrosis

Talar head fracture

20 years old male, status post MVA

The Talus: Fractures

- **Talar Neck Fractures :**
  - Traditionally considered the most common talar facture
  - *Anterior or inferior to the lateral process* of the talus and the talar dome cartilage
  - High incidence:
    - Small cross-sectional area
    - Vascular ingrowth, which increases the neck's porosity



Melenevsky,, **RadioGraphics 2015**

The Talus: Fractures

- **Talar Neck Fractures :**
  - Mechanism of injury:
    - First described in airplane pilots during World War I and termed ***aviator astragalus***
    - Motor vehicle or motorcycle collisions and high-level falls
    - Majority extended from the talar body or head

Mechanism:
- Combination of axial and dorsiflexion

The Talus: Fractures

- **Talar Neck Fractures :**

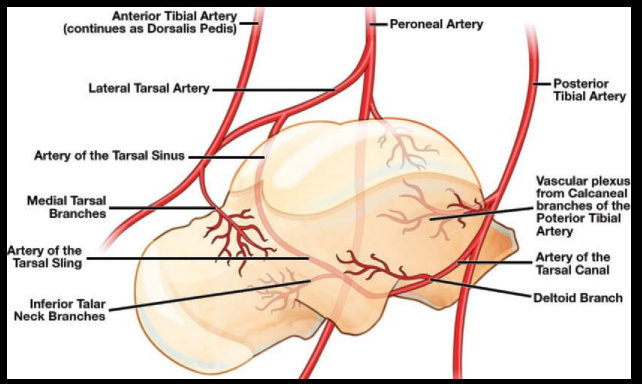
Table 1: Risk of Osteonecrosis in Hawkins-Canale–Type Talar Fractures

Fracture Type	Description	Risk of Osteonecrosis (%)
I	Nondisplaced talar neck fracture	0–15
II	Talar neck fracture and talocalcaneal dislocation	20–50
III	Talar neck fracture, talocalcaneal dislocation, and tibiotalar dislocation	100
IV	Talar neck fracture and disruption of all talar articulations	100

Melenevsky,, **RadioGraphics 2015**

The Talus: Fractures

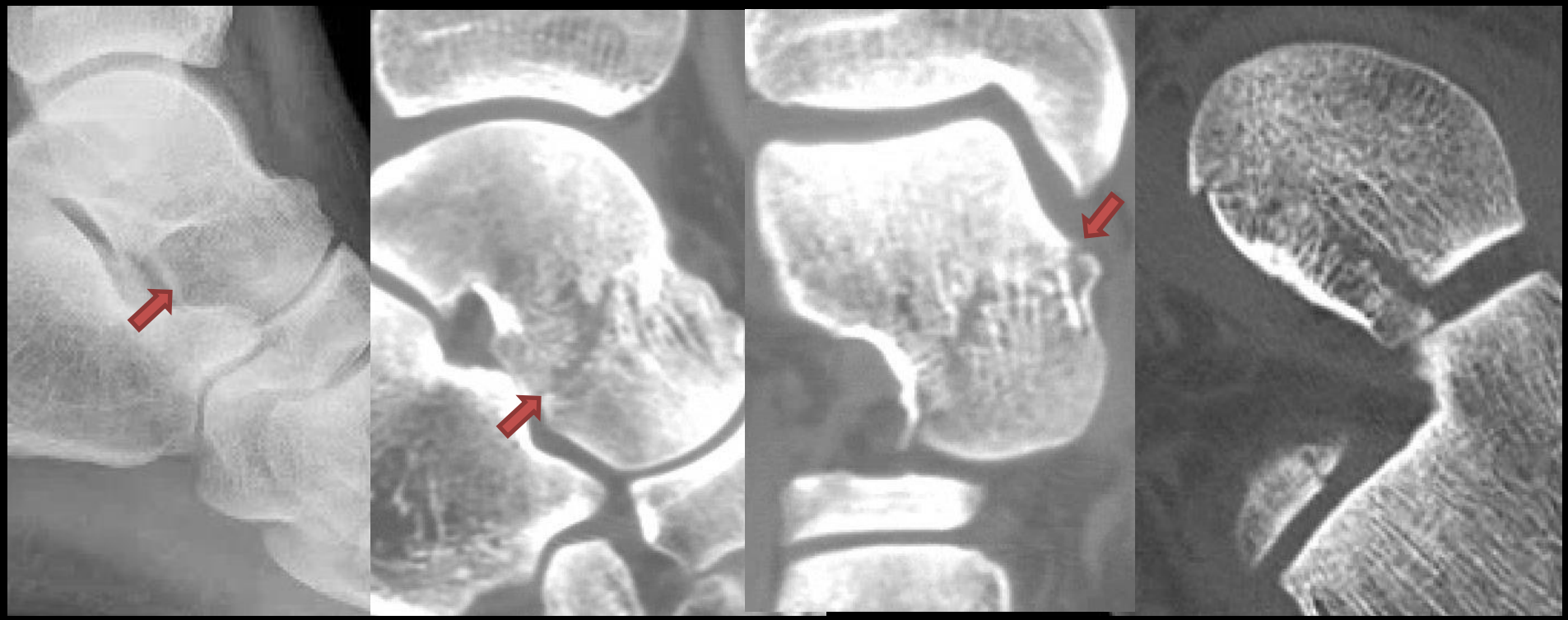
- **Talar Neck Fractures :**
  - Type I fracture: all three major sources of blood supply remain intact
  - Type II fractures: may lead to disruption of the artery of the tarsal canal
  - Type III fractures: disrupt both the artery of the tarsal canal and the deltoid and calcaneal branches
  - Type IV fractures: all three major sources of blood supply to the talus are likely compromised



Melenevsky,, **RadioGraphics 2015**

The Talus: Fractures

35 years old male, fall from car



Hawkins-Canale type I talar neck fracture

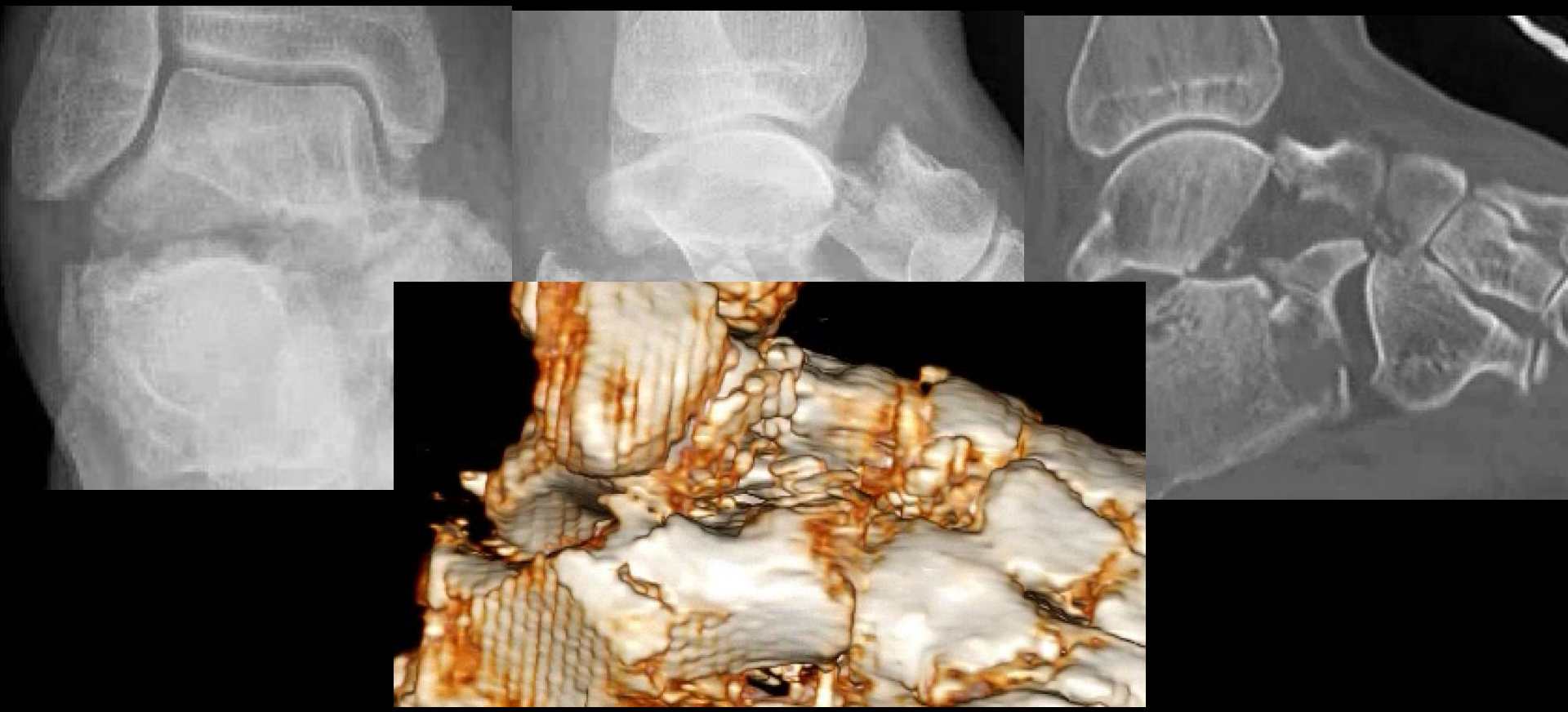
The Talus: Fractures

35 years old male, fall from car

Hawkins-Canale type I talar neck fracture

The Talus: Fractures

67 years old female, head on motor vehicle collision



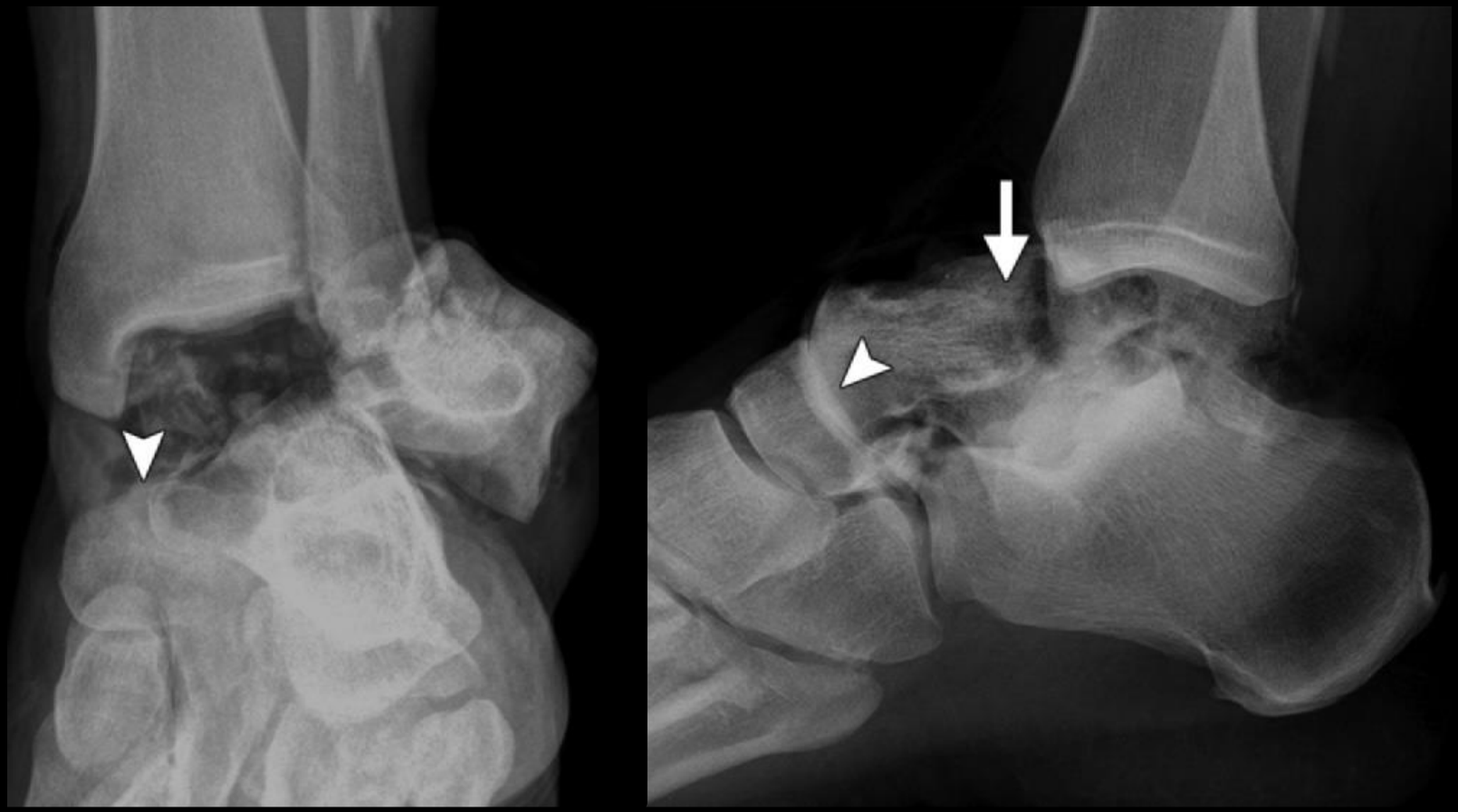
Hawkins-Canale type II talar neck fracture

The Talus: Fractures

29 years old male, status post fall from 25 feet

Hawkins-Canale type III talar neck fracture

The Talus: Fractures



Hawkins-Canale type IV talar neck fracture

Melenevsky,, **RadioGraphics 2015**

The Talus: Fractures

- **Talar Neck Fractures :**
  - Type I: Nonoperative management
  - Most type II fractures are treated with surgical reduction
  - Type III and IV fractures:
    - Closed reduction
    - Open reduction and internal fixation

Melenevsky,, **RadioGraphics 2015**

The Talus: Fractures

- **Talar Body Fractures :**
  - 13% to 61%
  - Simple, two-fragment fractures or extensively comminuted injuries
  - Majority of talar body fractures are displaced and will require operative treatment
  - Complications such as osteonecrosis and posttraumatic osteoarthritis are commonly encountered

Mechanism:
- High energy
- Shear and crush fractures
- Axial load on a dorsiflexed foot

The Talus: Fractures

- **Talar Body Fractures :**

Table 2: Sneppen Classification of Talar Body Fractures

Type	Description
A	Compression or osteochondral dome fracture
B	Coronal shear fracture
C	Sagittal shear fracture
D	Posterior tubercle fracture
E	Lateral tubercle fracture
F	Crush comminuted fracture

Melenevsky,, **RadioGraphics 2015**

Talar body fracture

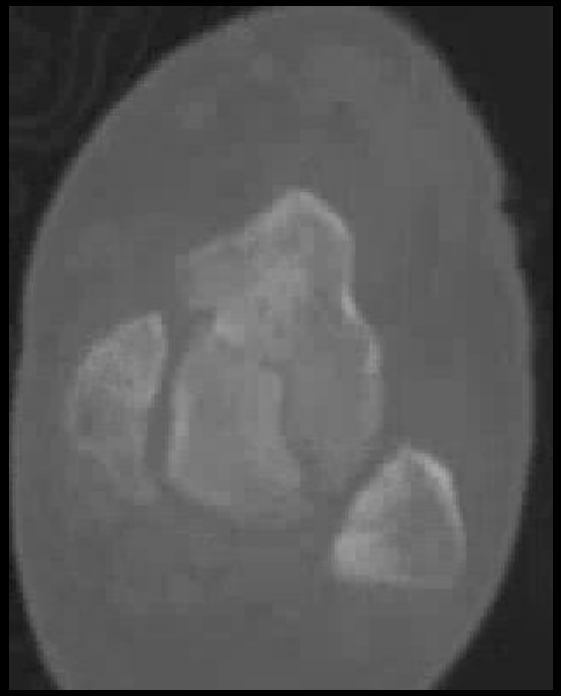
38 years old female, jumped off a cemented wall





Talar body fracture

20 years old male, status post trauma



The Talus: Fractures

- **Osteochondral Fractures of the Talar Dome:**
  - Impaction injury, which damages the articular cartilage and subchondral bone
  - 31% of talar dome compression fractures are occult on radiographs
  - *Lesion* and *fracture* have often been used interchangeably to describe osteochondral defects (OCDs).
  - OCD lesions account for about 1% of all talar fractures
  - The most commonly used system for classifying OCD lesions was presented by Berndt and Harty in 1959

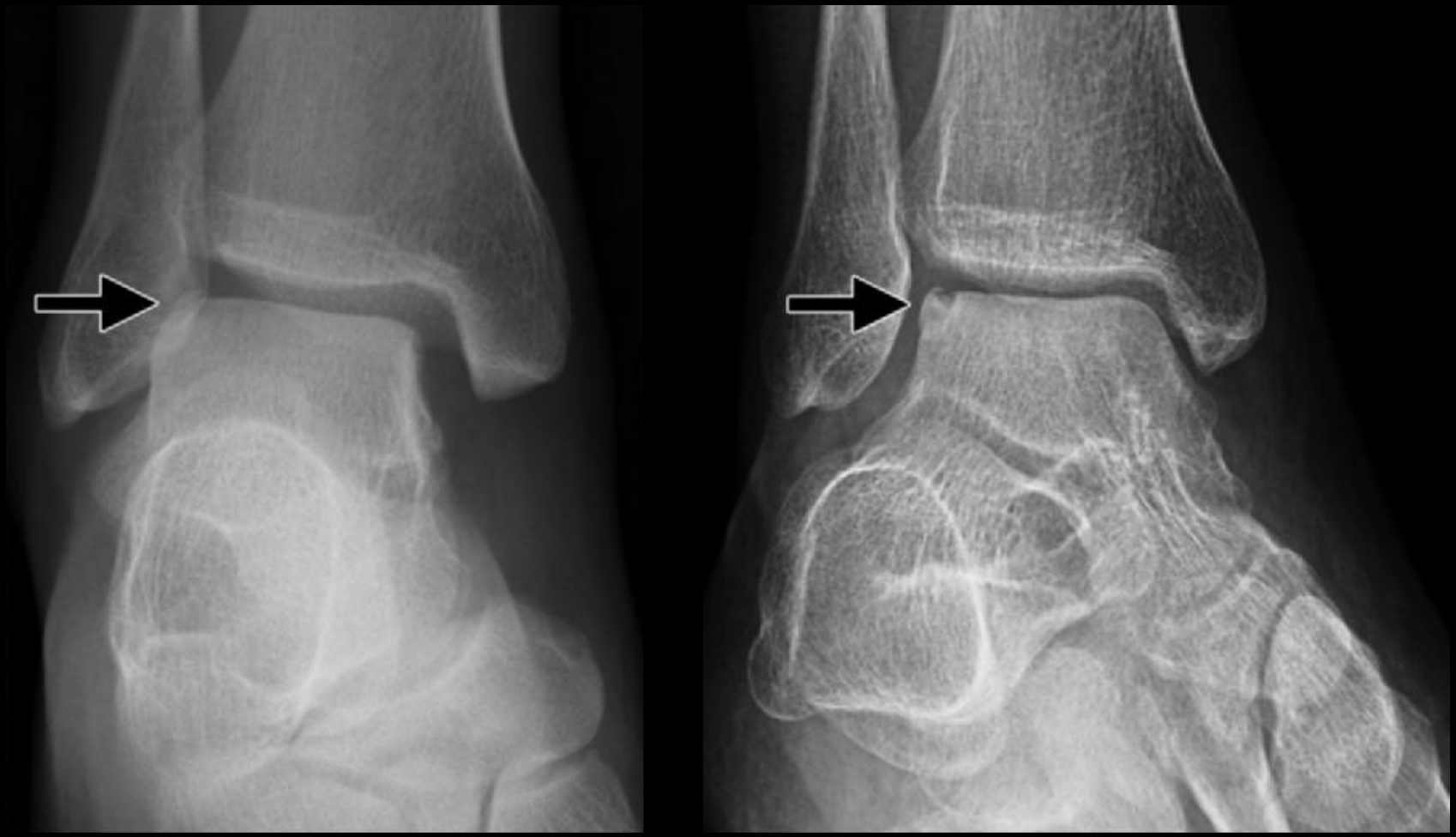
The Talus: Fractures

- **Osteochondral Fractures of the Talar Dome:**
  - Additional staging described by Scranton and McDermott in 2001
    - Stage 1 is subchondral bone compression
    - Stage 2 is a partially detached osteochondral fragment
    - Stage 3 is a completely detached but nondisplaced osteochondral fragment
    - Stage 4 is a completely detached and displaced osteochondral fragment
    - Stage 5 is a large cyst below the articular surface.

The Talus: Fractures

- **Osteochondral Fractures of the Talar Dome:**
  - Lateral lesions:
    - Shallow
    - Wafer-shaped
    - Dorsiflexion and inversion injuries
  - Medial lesions:
    - Less symptomatic
    - Deep and cup-shaped
    - Plantar flexion and inversion (Fig 12).
  - Stable and nondisplaced OCD fragments: heal
  - Displaced unstable fragments: AVN

Osteochondral Fractures



Melenevsky,, **RadioGraphics 2015**

Osteochondral Fractures

Melenevsky,, **RadioGraphics 2015**

The Talus: Fractures

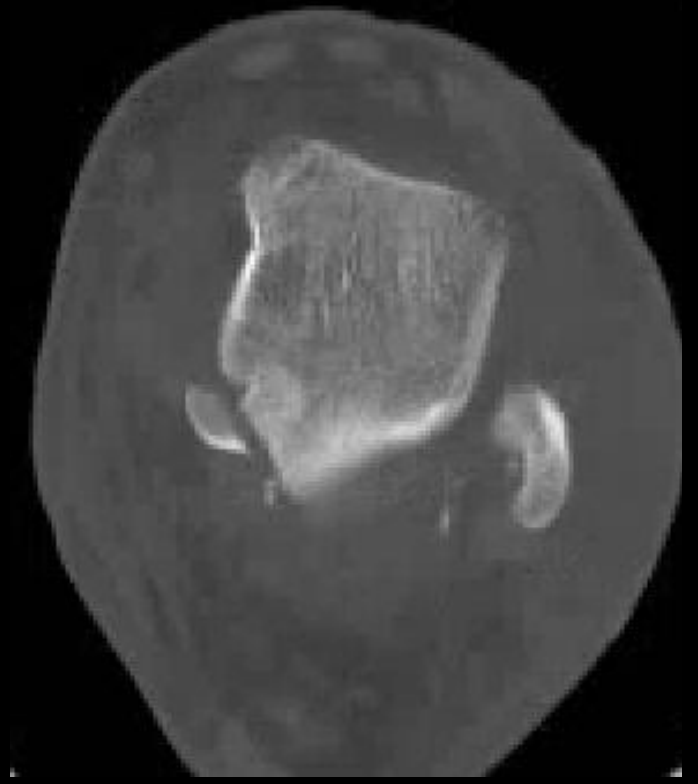
- **Posterior Process Fractures:**
  - Lateral tubercle (Shepherd fracture)
  - Medial tubercle (Cedell fracture) → posteromedial fragment
  - *Positive nutcracker sign:* Pain and crepitation on forced plantar flexion of the ankle
- Treatment: Immobilization or excision of the fragment

Mechanism:

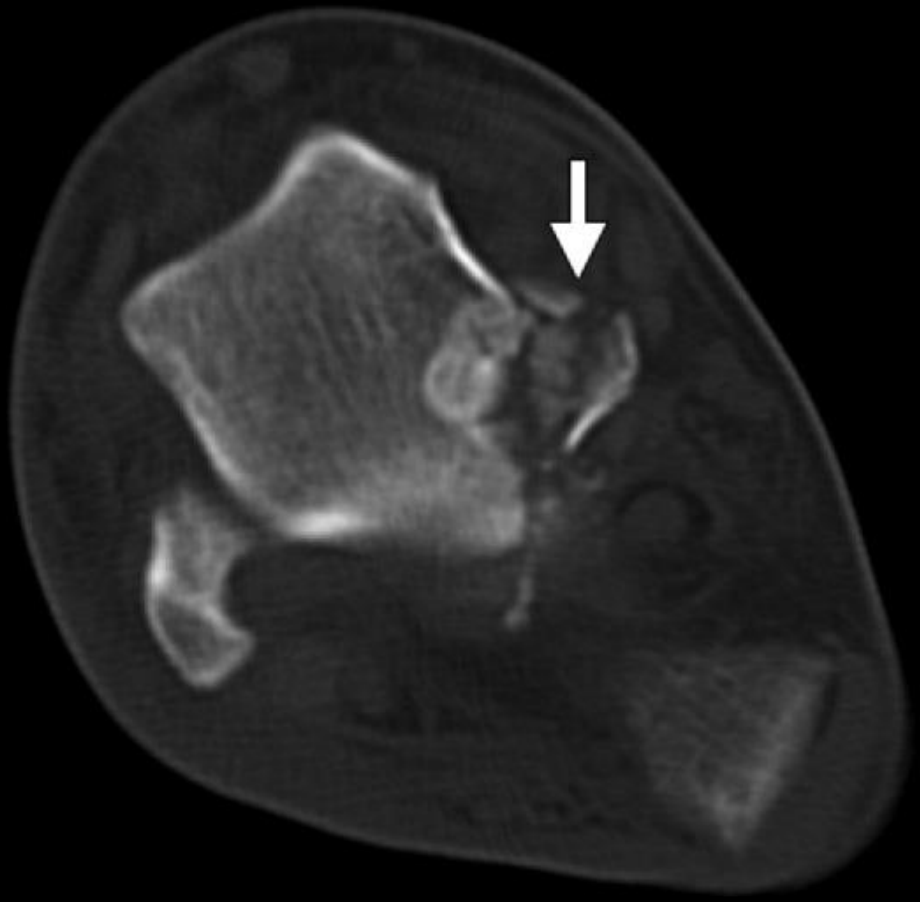
- Direct trauma or forced plantar flexion
- Dorsiflexion and pronation → avulsion of PTAF

Posterior Process Fractures

20 years old, status post injury



Posterior Process Fractures



Melenevsky,, **RadioGraphics 2015**

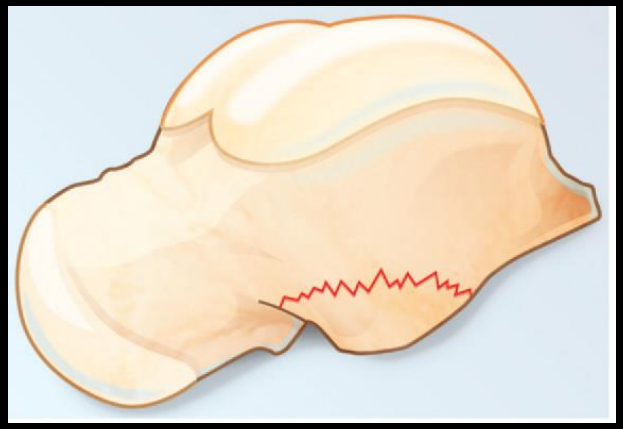
The Talus: Fractures

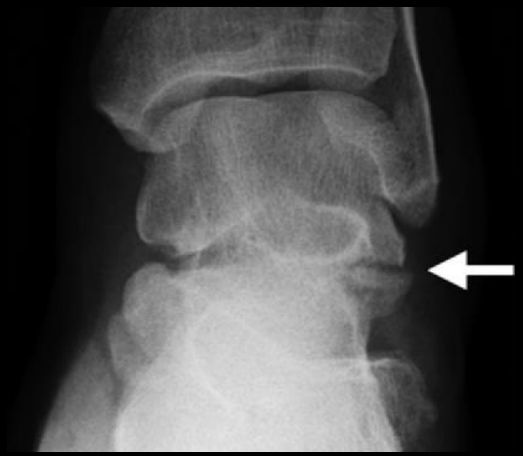
- **Lateral Process Fractures:**
  - Occult on initial radiographs → best on AP view
  - 2.3% of all snowboarding injuries
  - 15% of all ankle injuries
  - 19% of talar fractures in patients injured in motor vehicle accidents and falls from a height

Mechanism:
- Dorsiflexed
- Eversion
- Axial loading

The Talus: Fractures

- **Lateral Process Fractures:**
  - Classification (Hawkins criteria):
    - Simple (type I): Most common
      - Single fracture line extending from the talofibular articular surface to the subtalar joint

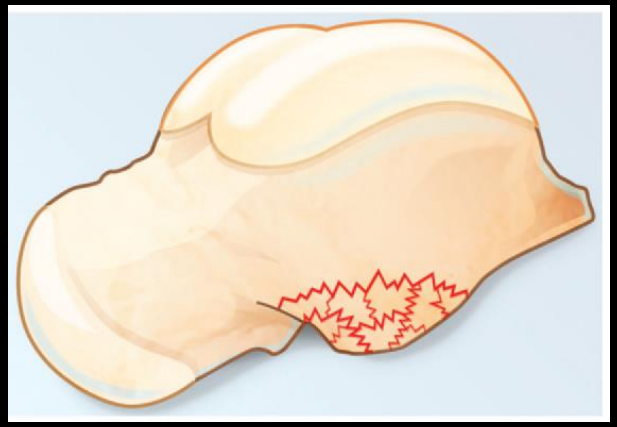




Melenevsky,, **RadioGraphics 2015**

The Talus: Fractures

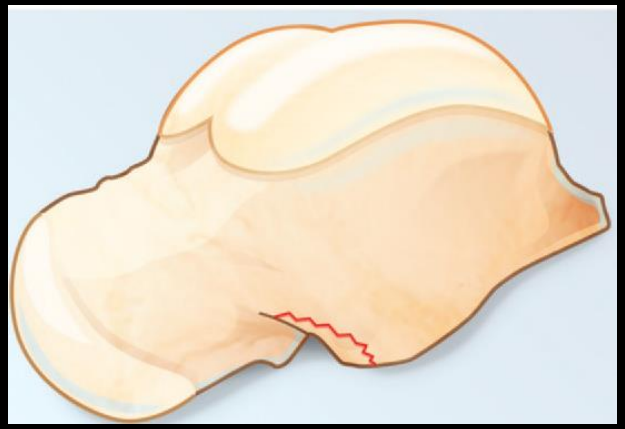
- **Lateral Process Fractures:**
  - Classification (Hawkins criteria):
    - Comminuted (type II)
      - Involving the entire lateral process and both articular surfaces



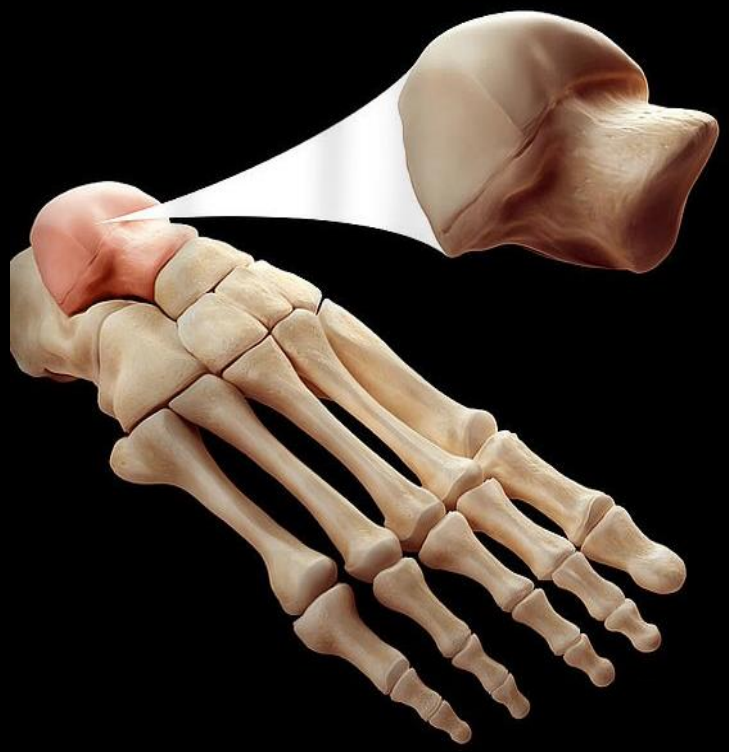
Melenevsky,, **RadioGraphics 2015**

The Talus: Fractures

- **Lateral Process Fractures:**
  - Classification (Hawkins criteria):
    - Chip (type III)
      - Region of the sinus tarsi and are usually visualized only on lateral radiograph



Melenevsky,, **RadioGraphics 2015**



- Anatomy
- Congenital
- Fractures
- Stress related injury

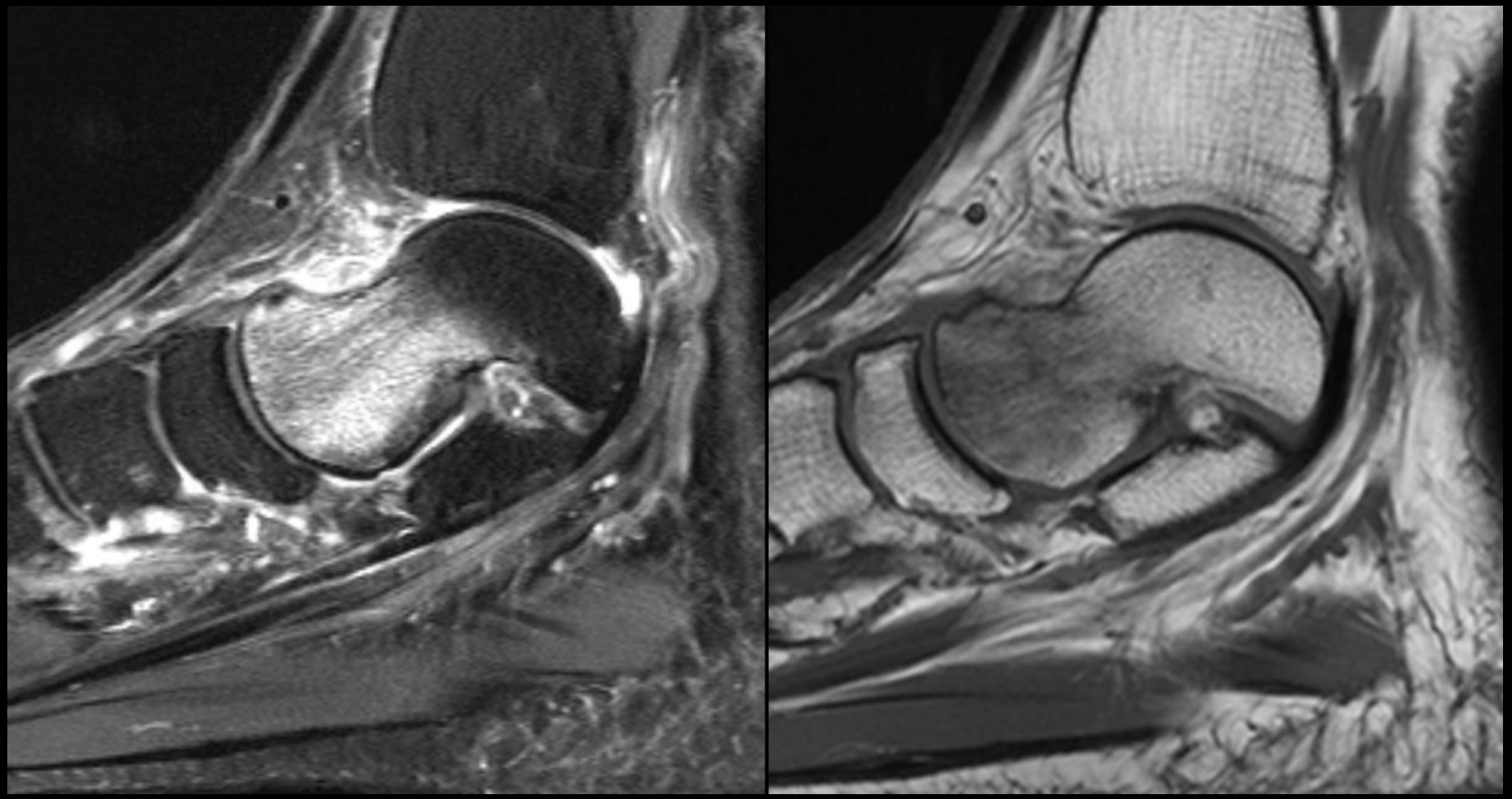
The Talus: Stress fractures

- Talus is a relatively uncommon site of a stress fracture
- First report by McGlone in 1965
- Athletes, military recruits, and sports enthusiasts
- Talar head stress fracture is the most common

http://radsource.us/stress-fractures-foot-ankle/

The Talus: Stress fractures

56-year-old female status post fall November 2018 with persistent ankle pain and edema. No additional history of trauma.



The Talus: Stress fractures

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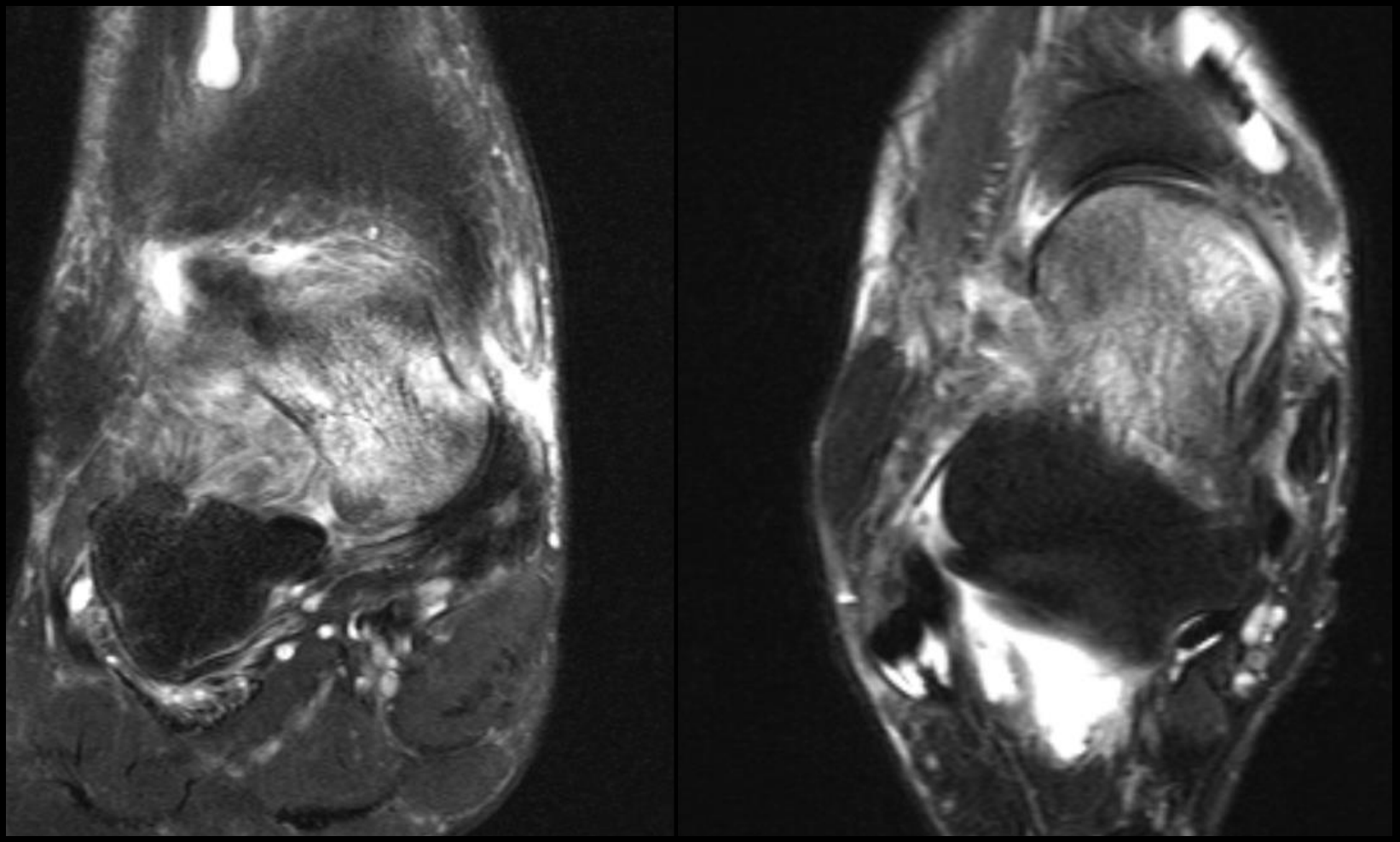
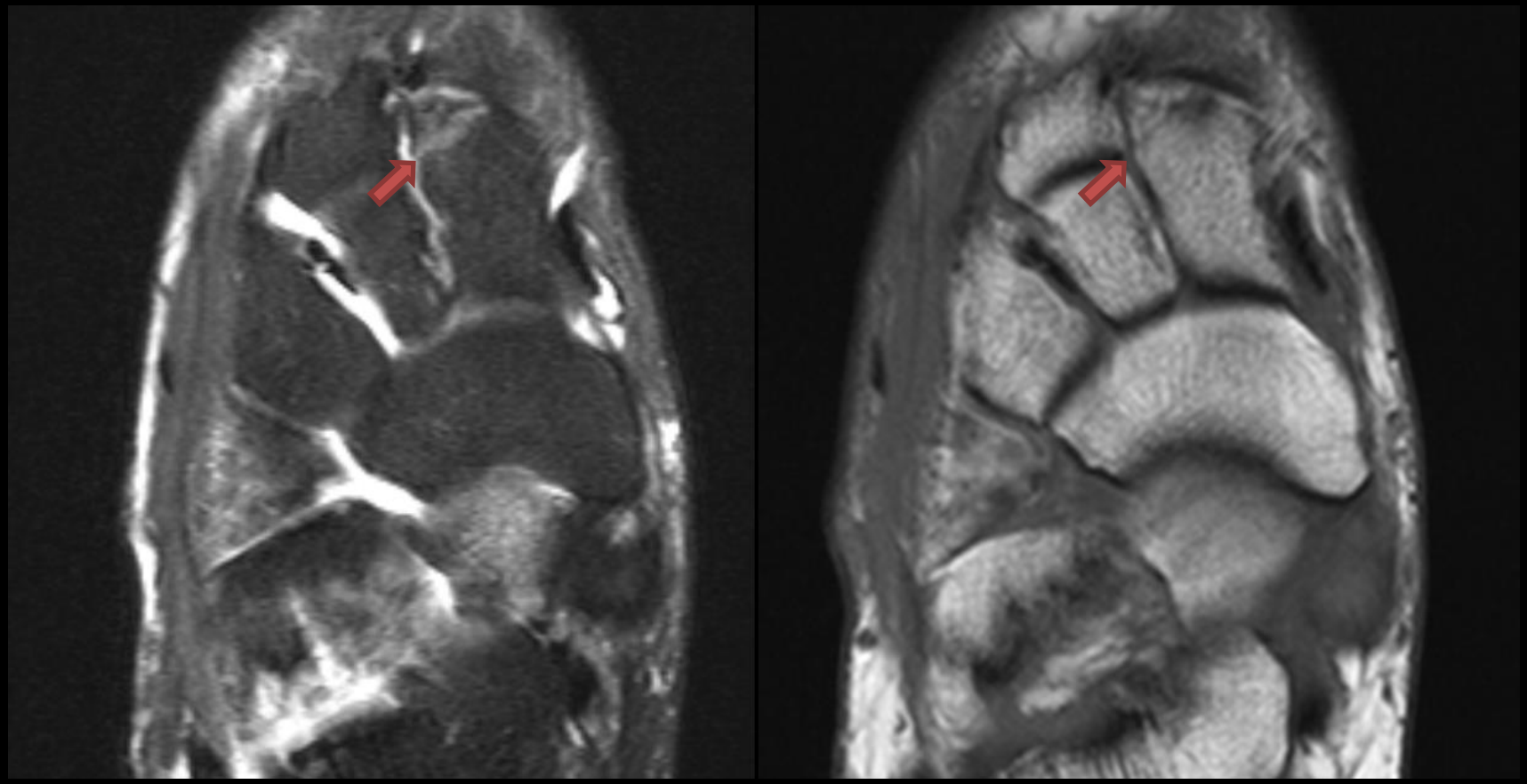
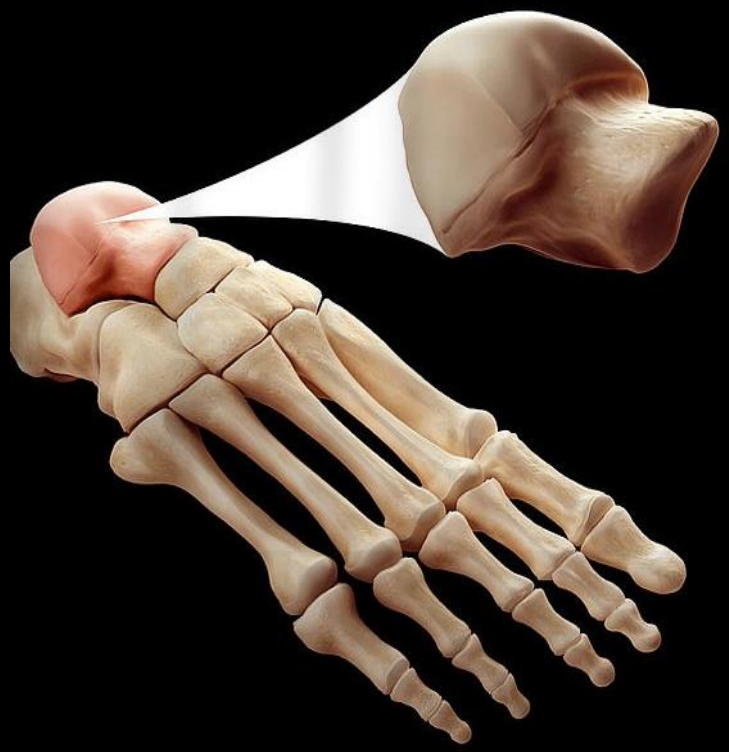


The Talus: Stress fractures

56-year-old female status post fall November 2018 with persistent ankle pain and edema. No additional history of trauma.





Anatomy

Congenital

Fracture

Stress related injury

AVN

The Talus: Avascular Necrosis

- Anatomic consideration:
  - 60% of its surface is covered by articular cartilage
  - No muscular or tendinous attachments
  - Only a limited area of penetrable bone is available for vascular perforation
  - Small nutrient vessels
  - Variations in intraosseous anastomoses
  - Lack of collateral circulation

The Talus: Avascular Necrosis

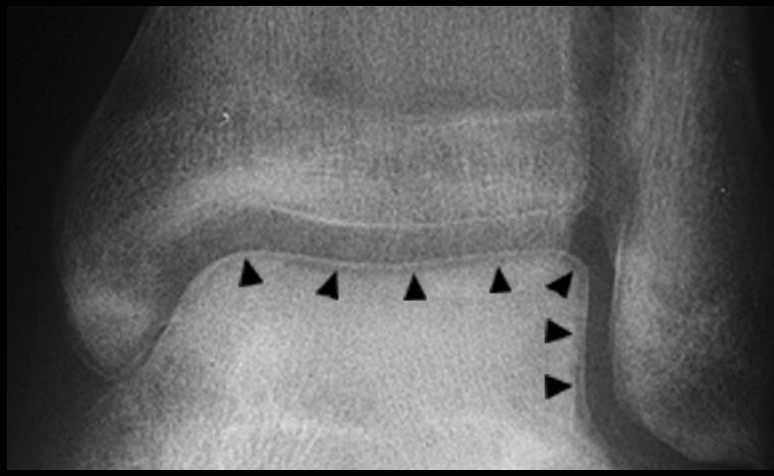
- AVN (osteonecrosis) of the talus:
  - Interruption in any part of the vascular network:
    - Arteries, capillaries, sinusoids, and veins
  - This interruption can be classified as:
    - Obstruction
    - Compression
    - Physical disruption
- The body's response to AVN is an attempt at repair by means of reossification, revascularization and resorption of necrotic bone → radiographic appearance of AVN

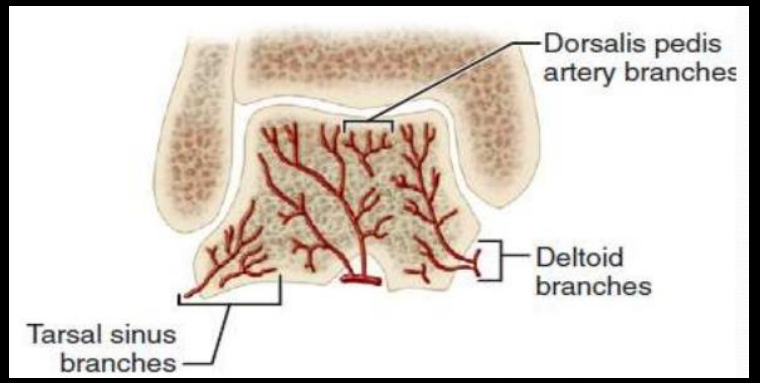
The Talus: Avascular Necrosis

- AVN (osteonecrosis) classification:
  - Traumatic
    - Fracture and dislocation of the talar neck
  - Atraumatic
    - Corticosteroids
    - Alcoholism
    - Systemic lupus erythematosus
    - Renal transplants
    - Sickle cell anemia
    - Hyperlipidemia
    - Irradiation
    - Inherited thrombophilias

The Talus: Avascular Necrosis

- Hawkins sign:
  - Thin subchondral radiolucent line along all or part of the talar dome
  - 6–8 weeks after injury
  - AP radiographs
  - Adequate blood supply
- Partial Hawkins: incomplete (partial) AVN → lateral > medical





Pearce, **RadioGraphics 2005**

The Talus: Avascular Necrosis

38 year old male, history of fall from fence.

The Talus: Avascular Necrosis

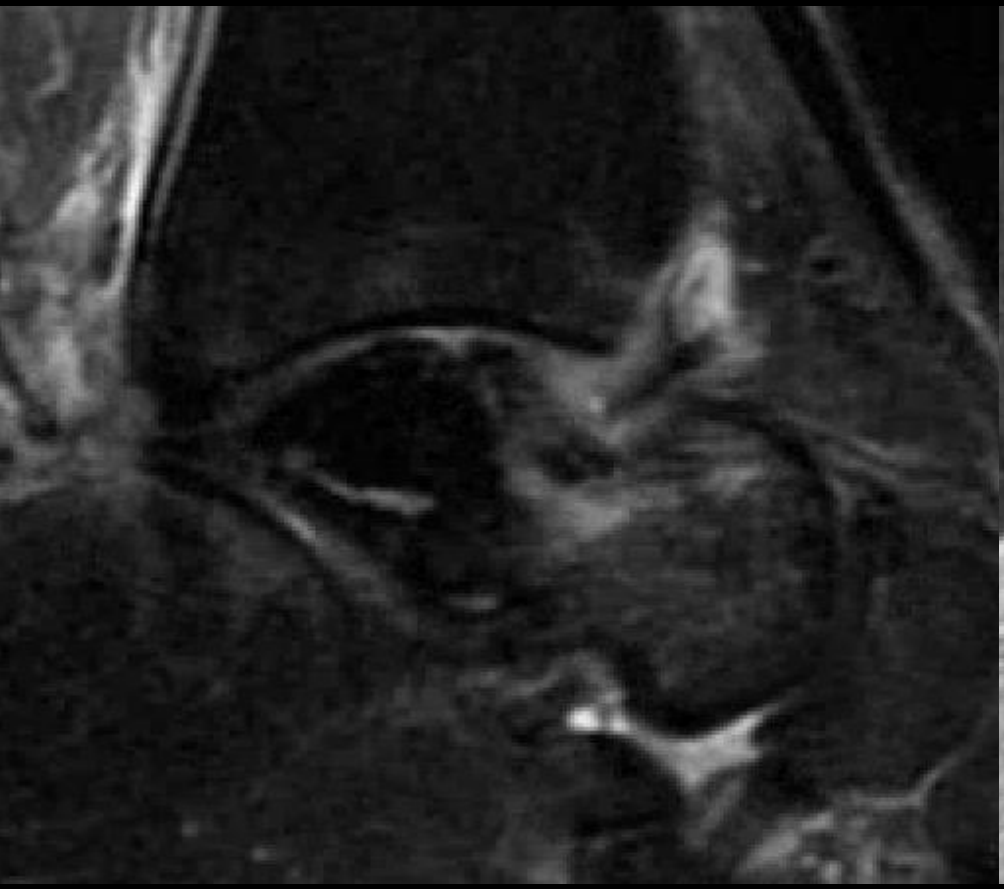
24 year old male, history of SLE. No Trauma.

The Talus: Avascular Necrosis

68 year old female, bilateral ankle pain. Obesity. No other risk factors.

The Talus: Avascular Necrosis

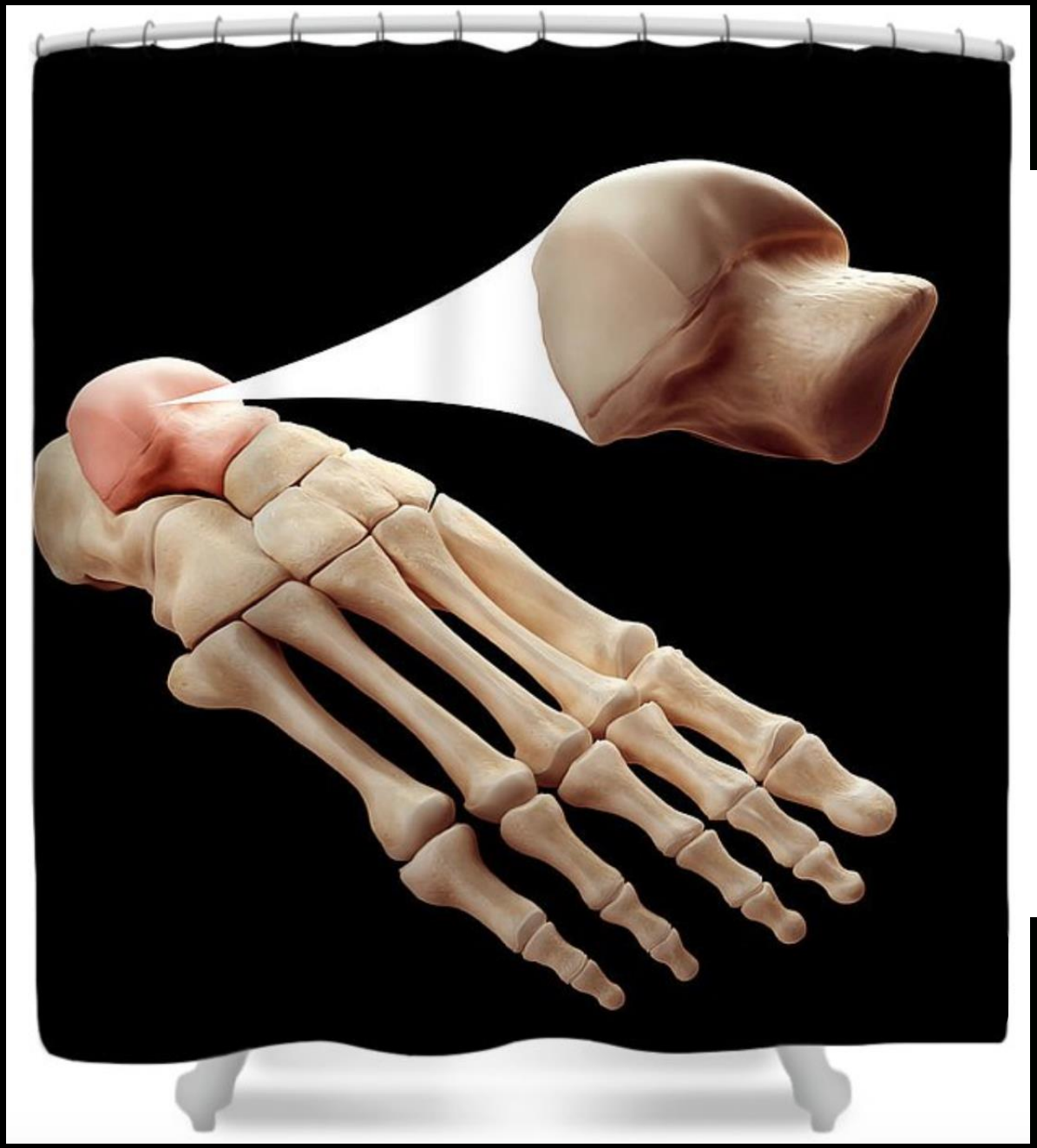
68 year old female, bilateral ankle pain. No Trauma.



The Talus: Avascular Necrosis

68 year old female, bilateral ankle pain. No Trauma.


"I, Talus of the House Tarsus, First of my Name, King of the Andals and the First Men, and Lord of the Seven Tarsal Kingdoms, protector of the realm END THIS PRESENTATION."



Talus Bone Shower Curtain

by **Science Picture Co**

$90.00

ADD TO CART

IMAGE SIZE

DESCRIPTION

Our shower curtains are made from 100% polyester fabric and include 12 holes at the top of the curtain for simple hanging from your own shower curtain rings. The total dimensions of each shower curtain are 71" wide x 74" tall.

SHIPS WITHIN

2 - 3 business days

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Obrigado
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Hvala
Merci
Danke
Tack
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Thank you
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Grazie
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Спасибі
Multumesc