

Pediatric Planovalgoid foot

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Fellowship in Paediatric Orthopaedics



Orthokids A'bad

BJ Wadia,
Mumbai



Plano Valgoid foot has the following components



Pes Planus



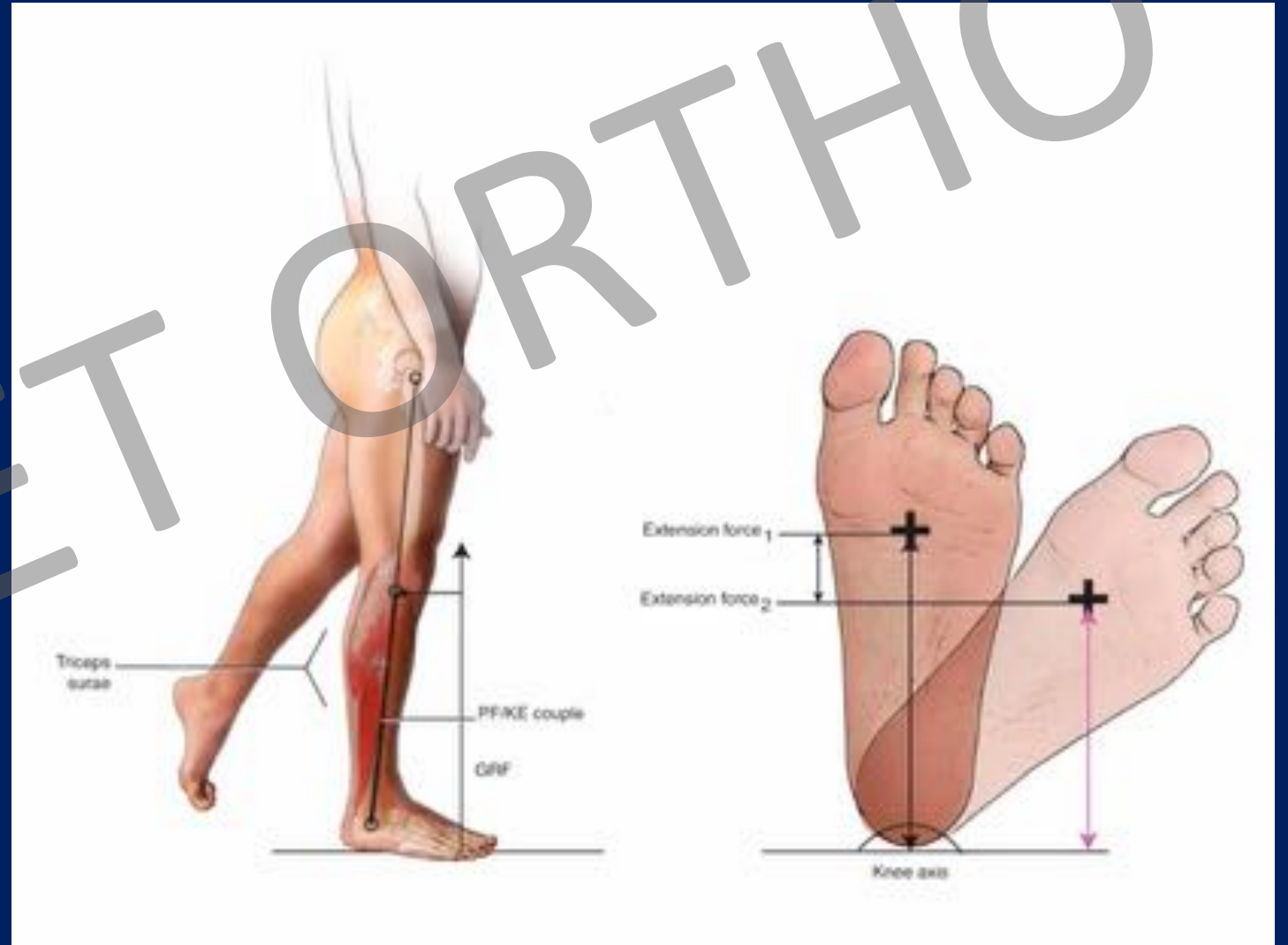
Heel Valgus;



Forefoot
abduction

Not Just a Cosmetic Problem

Lever Arm
dysfunction



Important to differentiate between

- Flexible Flatfeet

- Rigid Flatfeet

History

- Pain: Associations

Rheumatic; Tarsal Coalitions; Accessory Navicular; CVT

- Multiple sprains

Tarsal Coalition; CVT

- Family history

Familial flatfoot; HSP; CVT

- Progressive changes

Neurologic

Static Examination

- Toe walking test
- Toe Dorsiflexion Test
- Non weight bearing test
- Silfverskiold Test
- Subtalar range of motion
- Motor power assesment
- Neurocutaneous marker

Toe walking
test

Toe Dorsiflexion
Test (Jack's)



Foot Examination

In Non weight Bearing and
Weight Bearing



Foot Examination

In Non weight Bearing and
Weight Bearing



Silverskiold Test





Locking the Subtalar Joint



Subtalar ROM Assessment



Motor Power Assessment



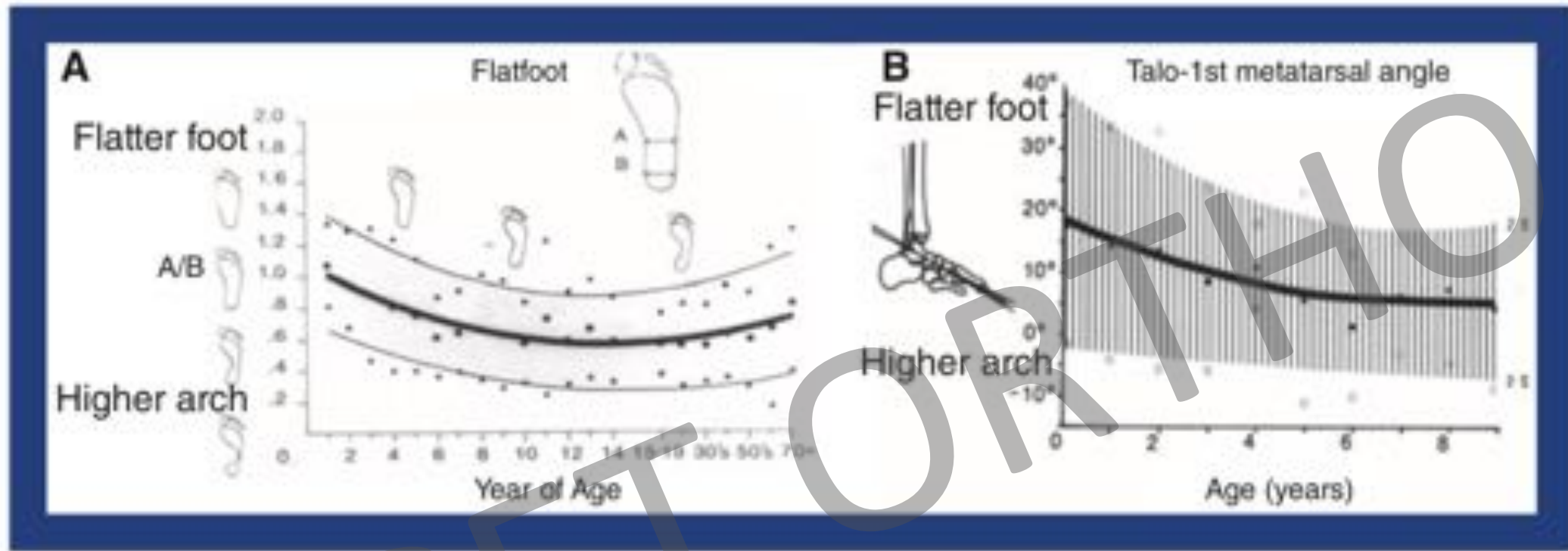
Examination of Back/ Spine





2 year old child. Mother complains of abnormal walking pattern. No pain.

Flexible flatfeet



Infants and toddlers in majority have flatfeet

Due to:
Subcutaneous fat
Ligamentous laxity

Lynn Staheli

“Flatfeet are a usual in infants; Common in children and unusual in adults”



Mx:

Corrective shoes and inserts as treatment for flexible flatfoot in infants and children

D R Wenger¹, D Mauldin, G Speck, D Morgan, R L Lieber

Does not change Natural History

The influence of footwear on the prevalence of flat foot. A survey of 2300 children

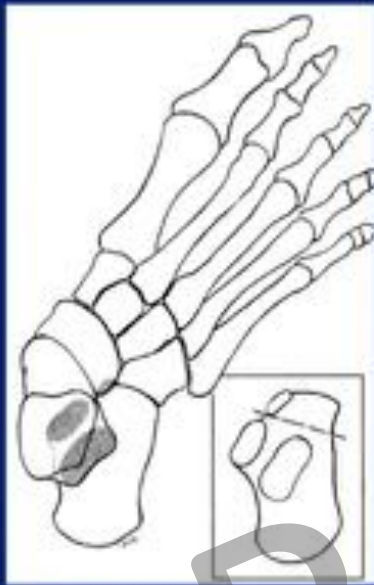
U B Rao¹, B Joseph

Early footwear was ass/w Flatfoot

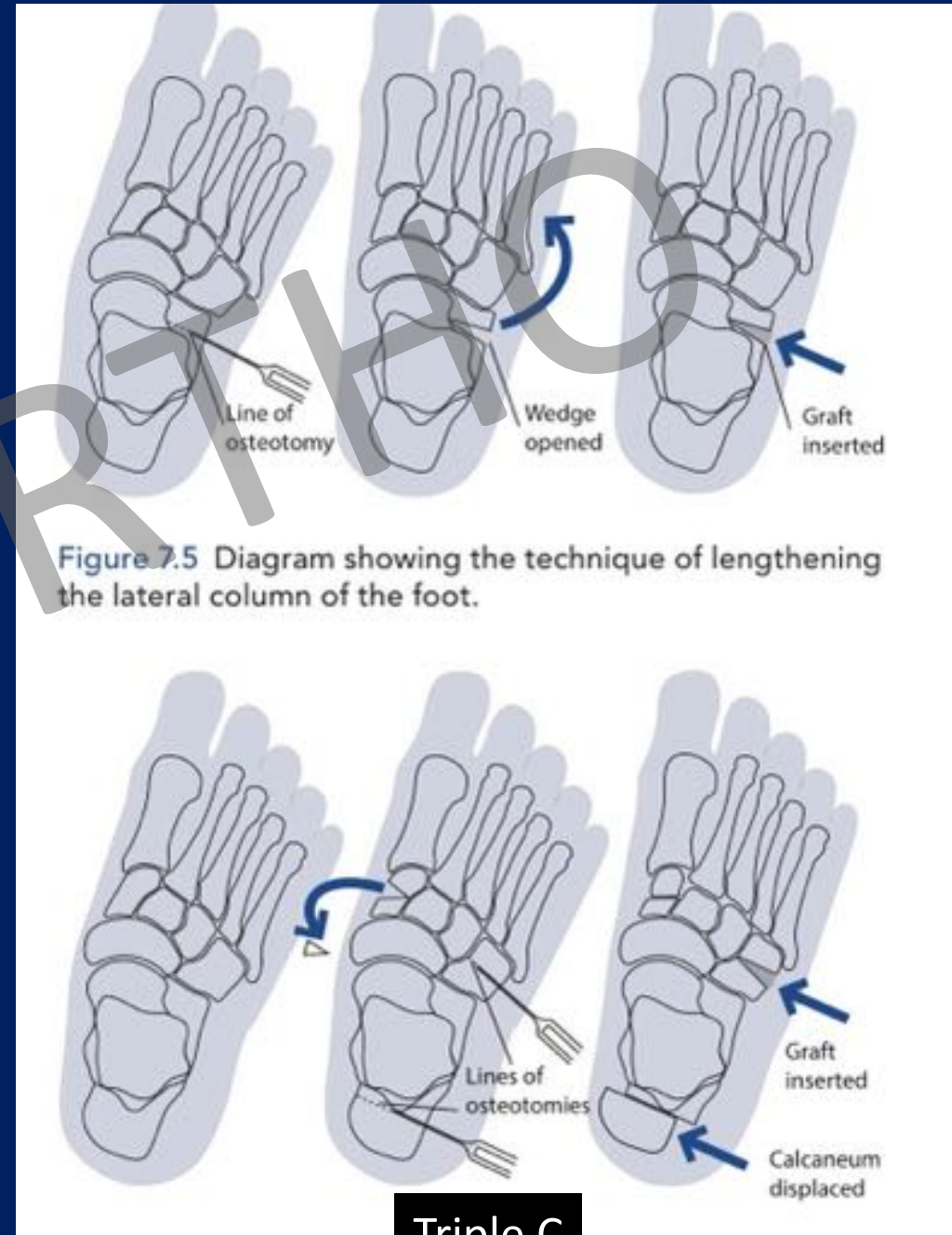
Cause of pain in FFF



Sx for PVF



Morcas Procedure (Evan's Modification)



Triple C





3 year old child. Mother complains of abnormal walking pattern. No pain.





Congenital Vertical Talus

Congenital Vertical Talus

Hindfoot **valgus and equinus**, with associated **midfoot dorsiflexion**
and

forefoot **abduction** caused by a

“fixed dorsal dislocation of the navicular on the head of the talus”.

Rare (1:10,000)

50% associated with Neurological abnormalities

THE PATHOLOGICAL ANATOMY OF CONVEX PES VALGUS

JAMES C. DRENNAN* and W. J. W. SHARRARD, SHEFFIELD, ENGLAND

From the Congenital Anomalies Research Unit, University of Sheffield

1971

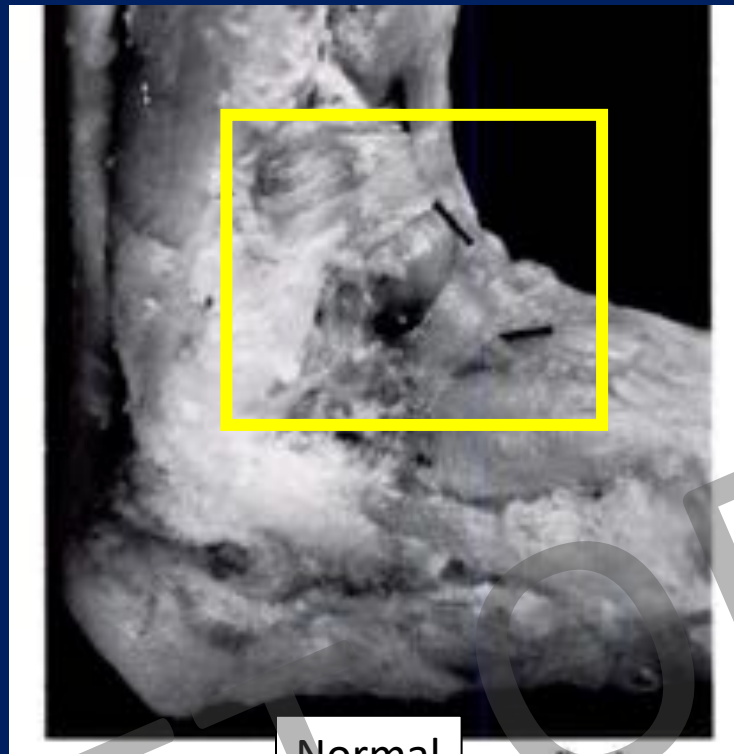
Autopsy study

Lateral Aspect

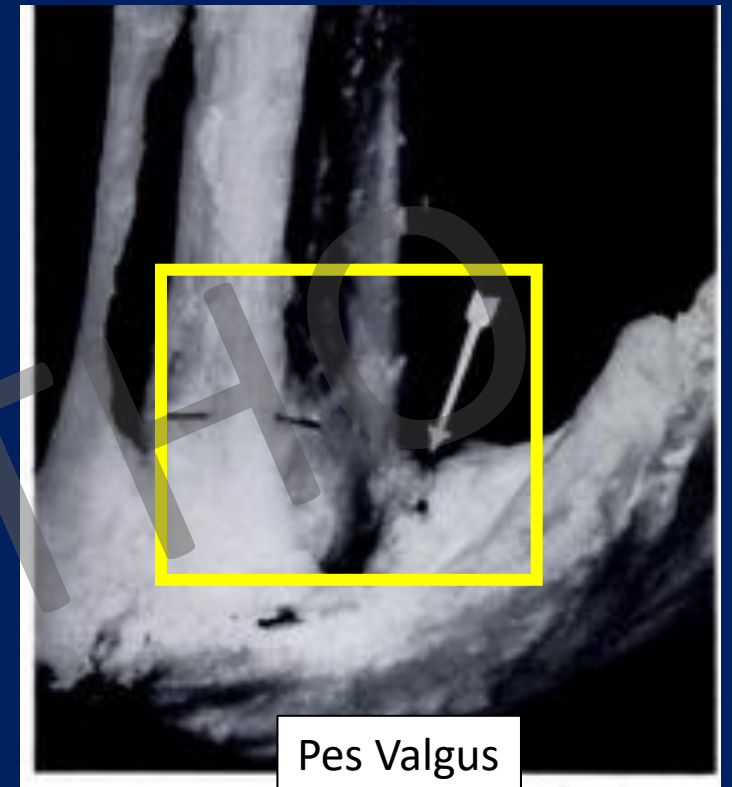
Extensor Retinaculum

Peroneal Bowstringing

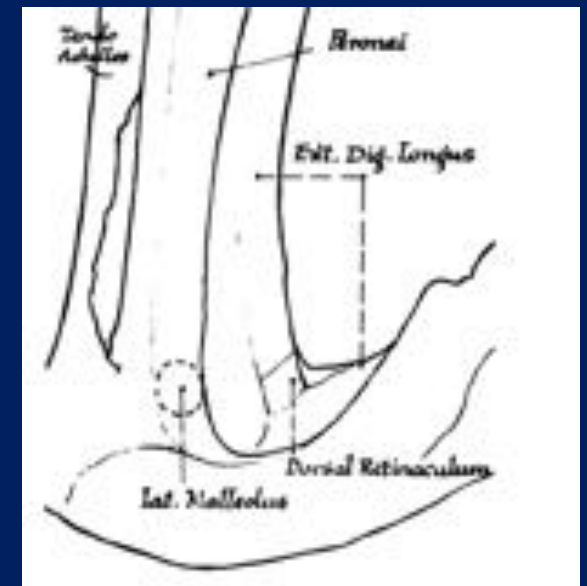
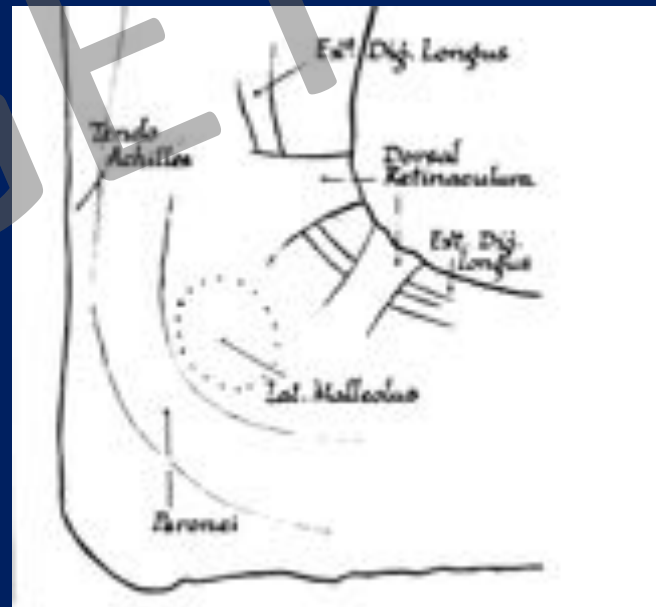
Triceps Surae



Normal



Pes Valgus

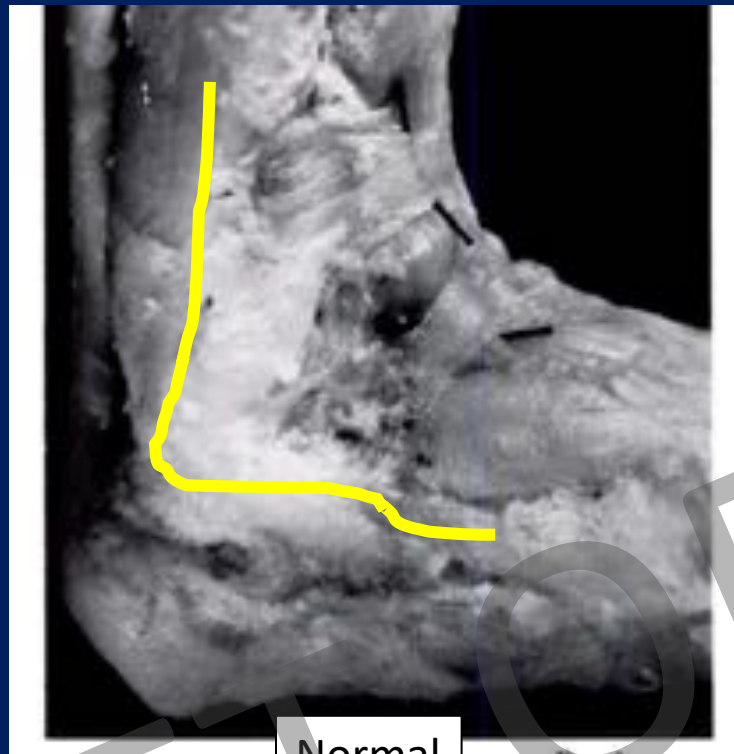


Lateral Aspect

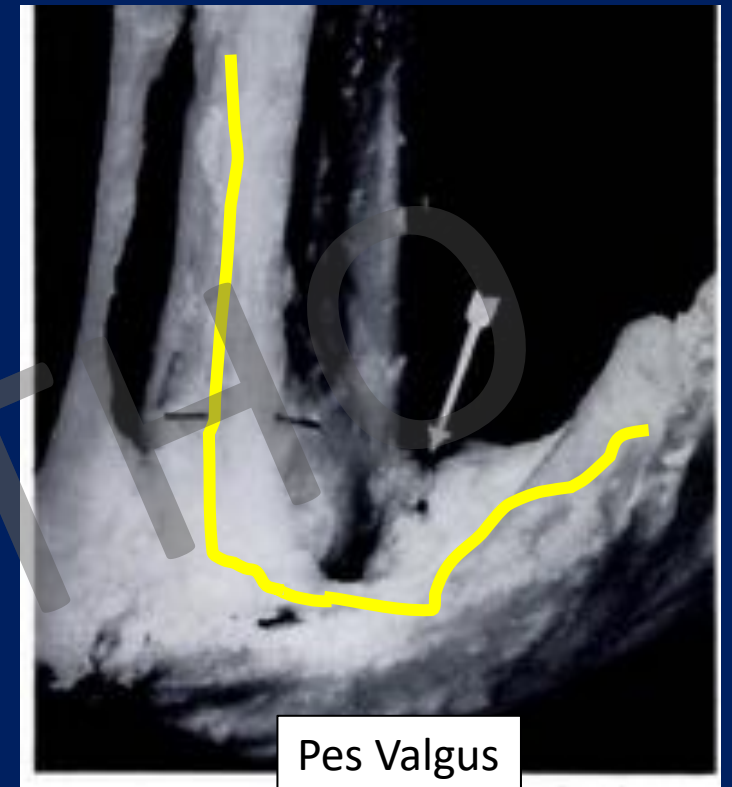
Extensor Retinaculum

Peroneal Bowstringing

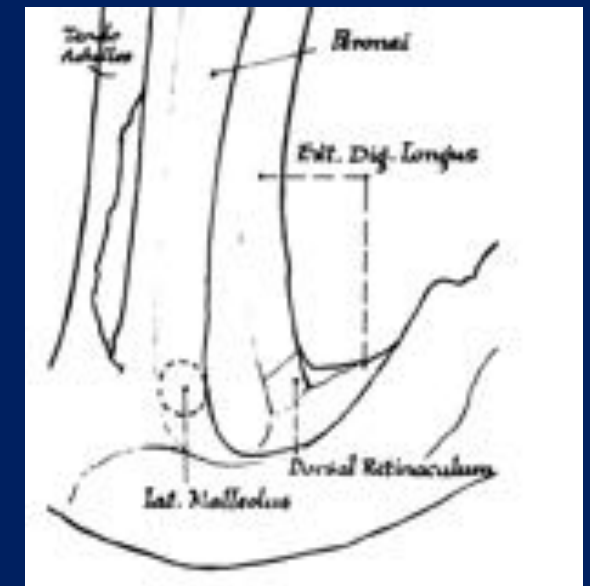
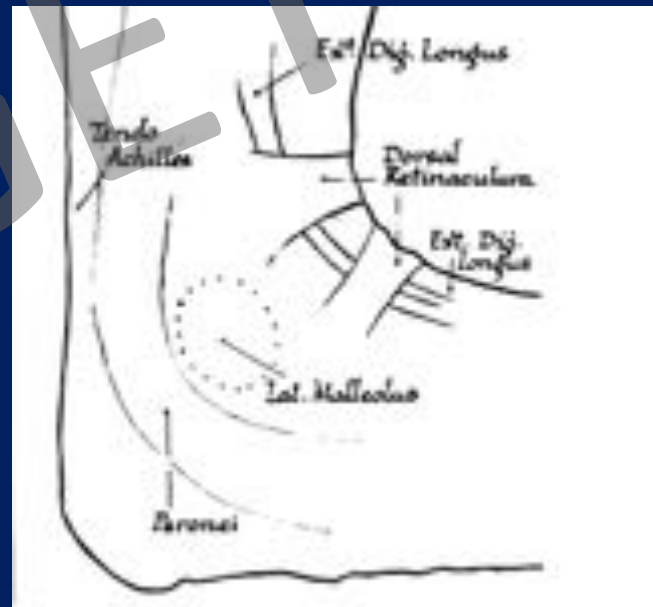
Triceps Surae



Normal



Pes Valgus



Lateral Aspect

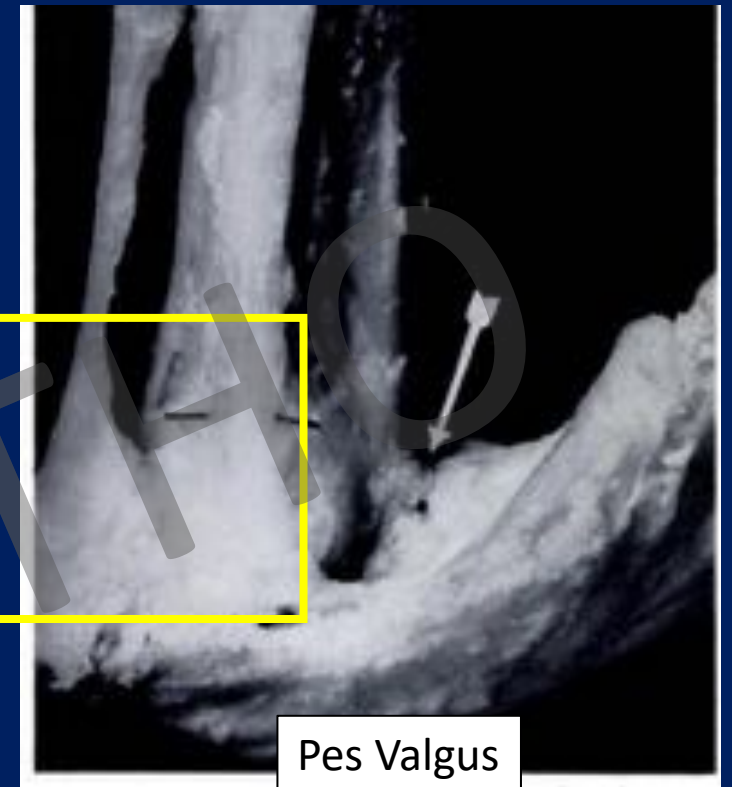
Extensor Retinaculum

Peroneal Bowstringing

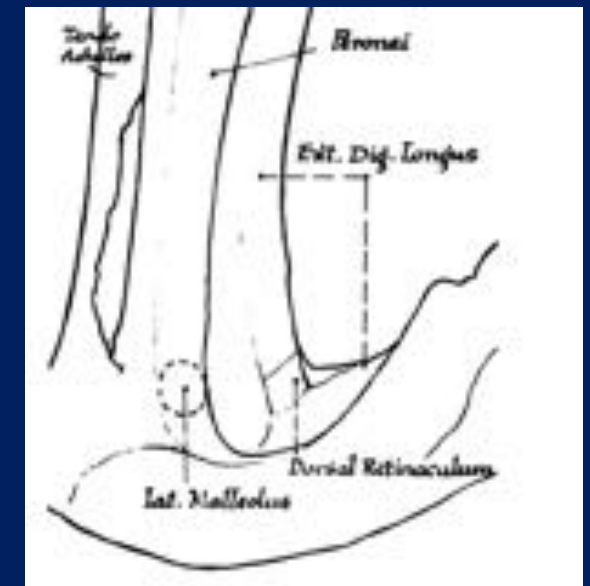
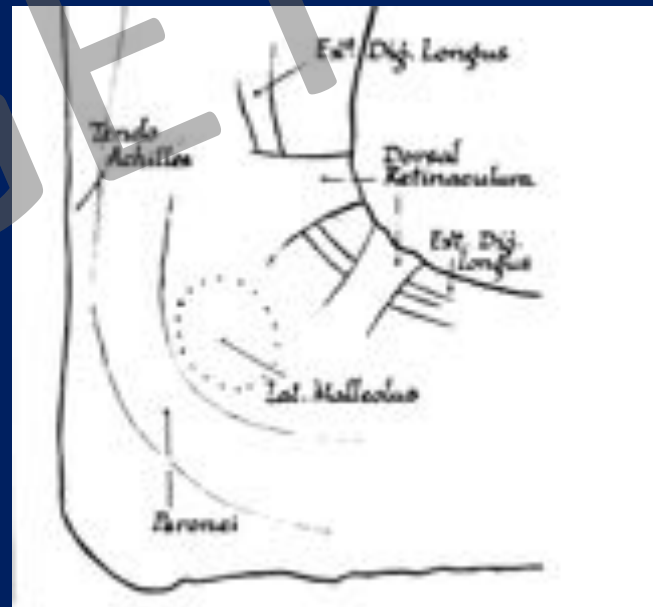
Triceps Surae



Normal



Pes Valgus

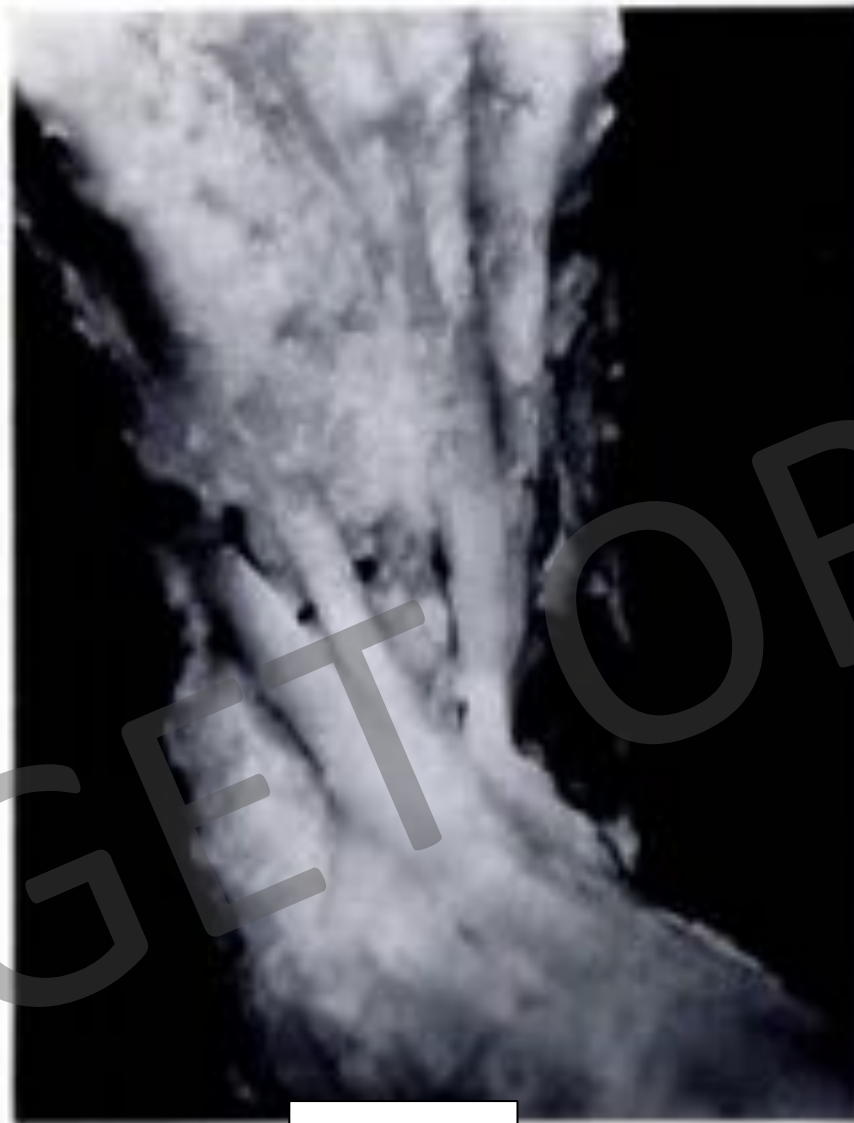


Dorsal Aspect

Tib Anterior

EHL

EDL



Normal



Pes Valgus

Figure 5—Anterior view of tendons crossing the dorsum of the normal ankle. Figure 6—Anterior view of convex pes valgus ankle. Note the medial displacement of extensor digitorum longus which causes the increased lateral angle of its tendons to the lateral rays. Peroneus tertius is indicated by a separate black marker.



FIG. 4

Plantar structures in convex pes valgus foot. The marked change in the course of the major tendons is seen.

- Plantarflexion of heel- Triceps Surae



- Inverter weak – Tibialis posterior



- Evertor Overpower- Peronei, EDL

Bones

- **Talus:**

Head and neck Hypoplastic;
Sustenaculum tali blunted;
No anterior TC joint,

- **Calcaneum:**

Laterally displaced and everted.
Plantarflexed
Posterior TC joint laterally tilted.



MRI Based Pathoanatomy study

- Besides the Dorsal Navicular subluxation there is **eversion of the calcaneus and CC Joint affection**
- Changes in **Subtalar joint**,
Not previously realized.



FIGURE 3. Sagittal view of the foot and ankle (T1-weighted image): distal cavus between plantarflexed first metatarsal and medial cuneiform (white arrow) and calcaneocuboid joint subluxation (thick black arrow).

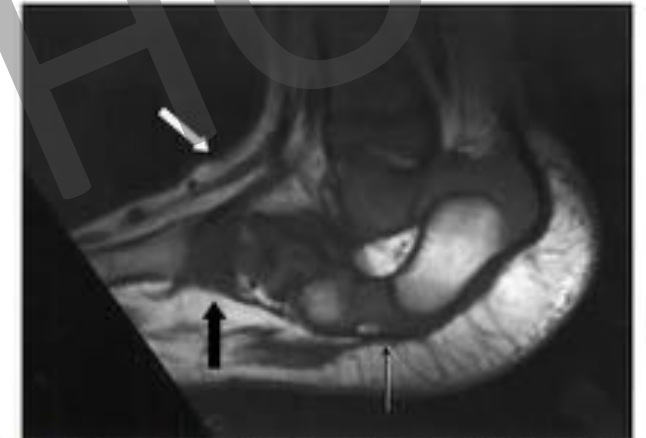


FIGURE 4. Sagittal view of the foot and ankle (T1-weighted image): calcaneocuboid joint subluxation (thin black arrow); bowstring of the extensor retinaculum (white arrow); distal cavus (thick black arrow).

> J Pediatr Orthop. Jul-Aug 2010;30(5):460-4. doi: 10.1097/BPO.0b013e3181df85e4.

MRI pathoanatomy study of congenital vertical talus

John G Thometz ¹, Hongsheng Zhu, Xue-Cheng Liu, Channing Tassone, Shari R Gabriel

Clinical Features

1. Important to examine the deformity
2. Assess related power
3. Examine the back
4. Head to toe examination

- Hindfoot: equinus, valgus, forefoot : abduction, & dorsiflexion
- Palpable Medial side talar head.



Differentials



Isolated Calcaneus
deformity



Posteromedial
bowing of the tibia



Positional
calcaneovalgus
foot

Examination of Back/ Spine







Genetic



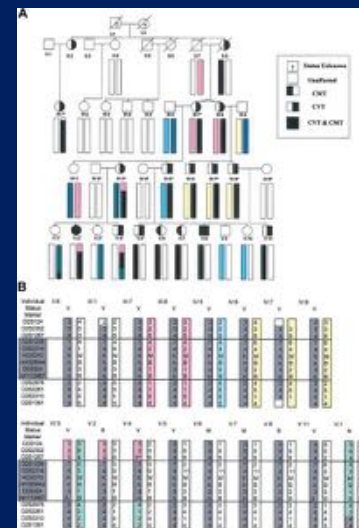
De Barsy Syndrome
 (C) www.targetortho.com
 Online Wiley library



aneuploidy of chromosome 13, 15 and 18.
 -Cleveland Clinic



Costello syndrome
 -Italian Journal of pediatrics



HOXD10 Mutation

To summarize

Central nervous system/spinal cord

- **Myelomeningocele**
- Spinal muscular atrophy
- Diastematomyelia
- Sacral agenesis

Muscle

- **Distal arthrogryposis**
- Arthrogryposis multiplex
- Neurofibromatosis

Chromosomal abnormality

- **Trisomy** 18
- Trisomy 15
- Trisomy 13

Known genetic syndromes

- Neurofibromatosis
- Prune-Belly syndrome
- Rasmussen syndrome
- Split hand and split foot
- Costello syndrome
- De Barsy syndrome

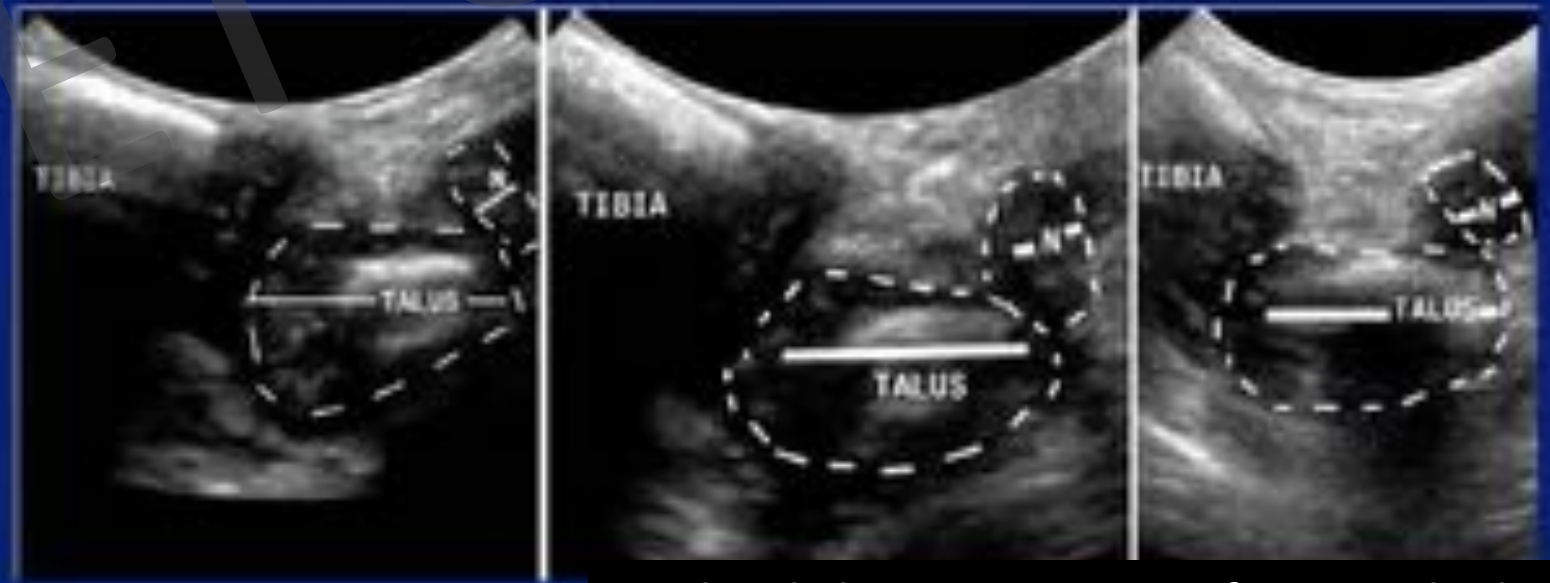
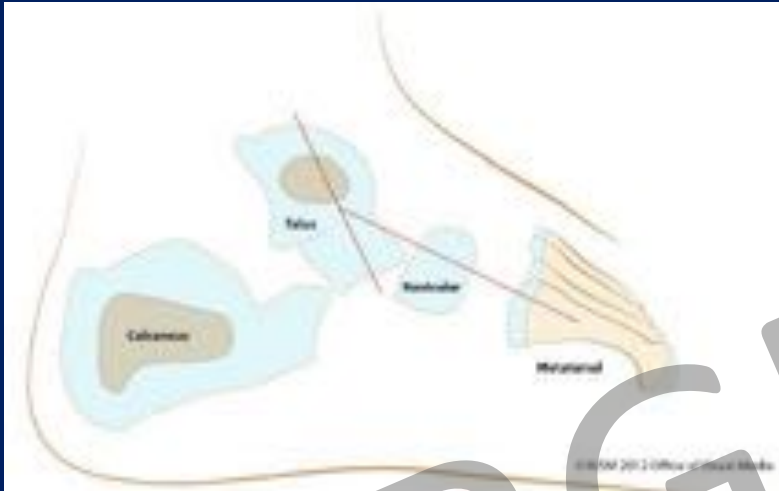
Single gene defects

- **HOXD10**
- CDMP1

Radiology

- USG in Neonates
- Xray with 1st MT consideration in 0-2 Years (PF/DF Views)
- Xray with Navicular as axis > 2 years (Weight bearing views)
- MRI Spine to rule out underlying cord issues.

Obl Talus



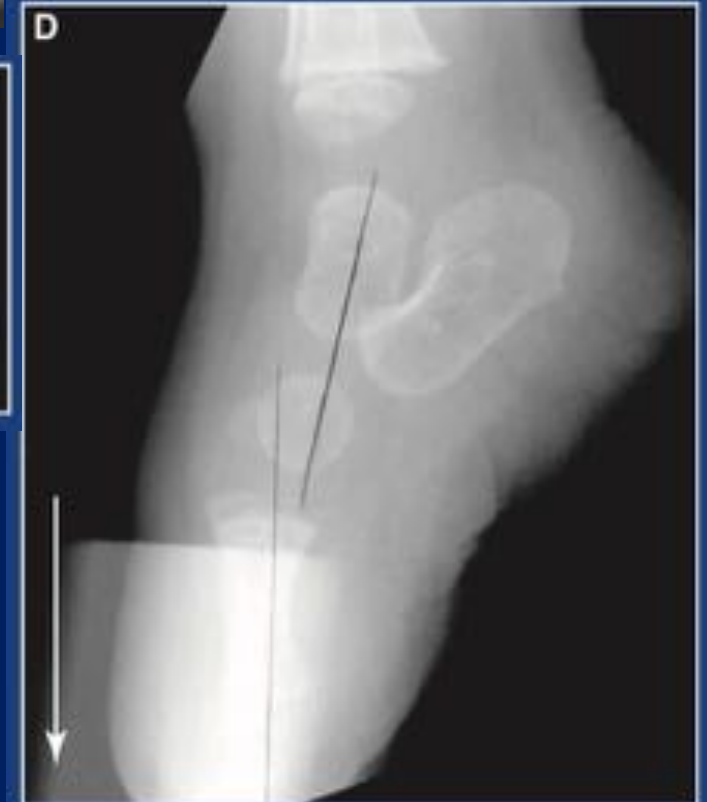
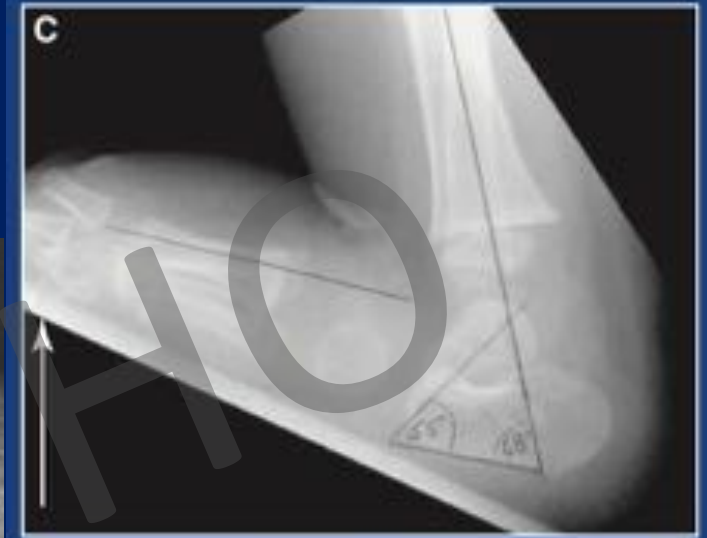
Vertical Talus

Lateral- PF View/DF View

- Dorsal Subluxation of Navicular/
Non collinear lines of 1st MT axis(0-2 years) and Talar axis

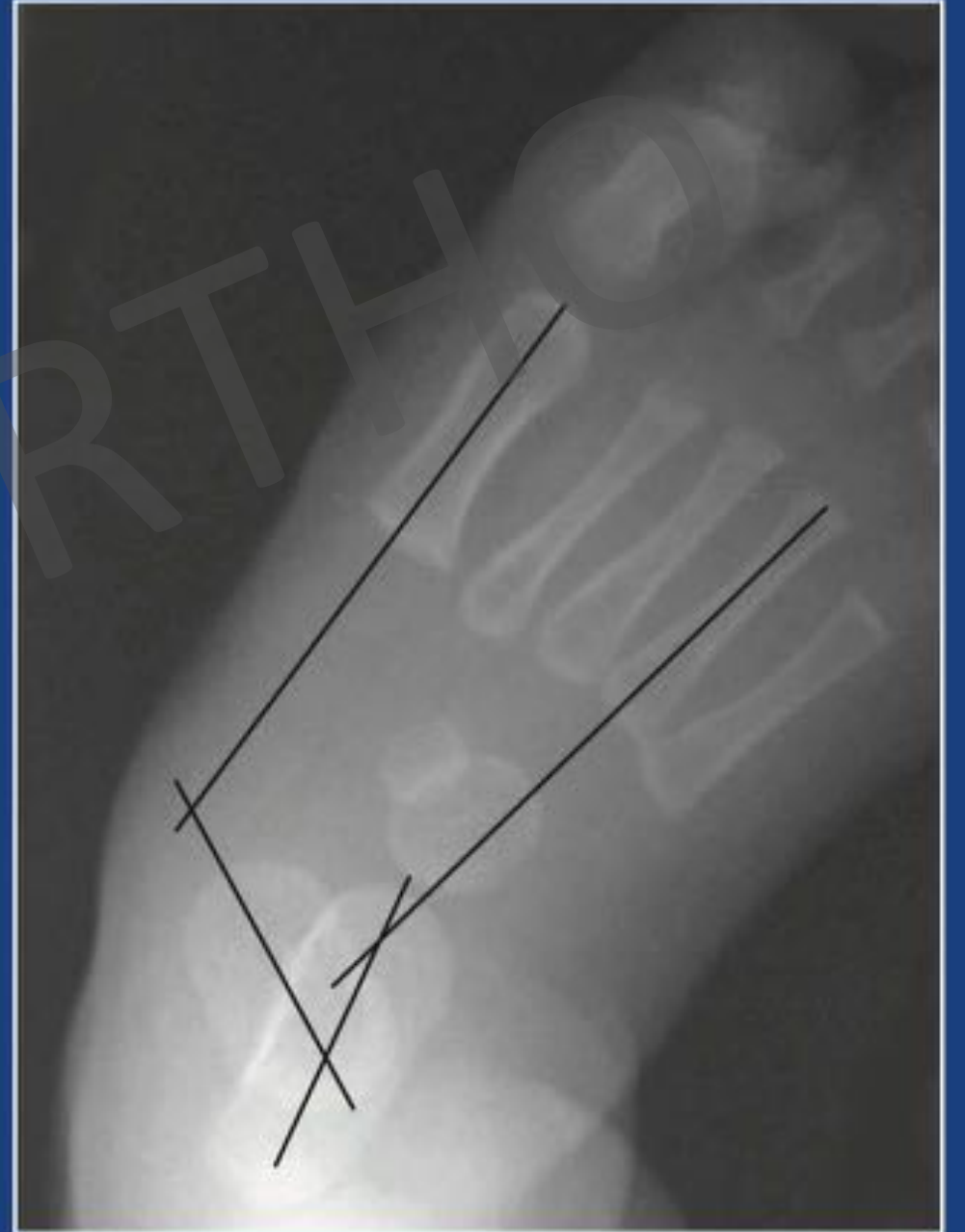
The talar and Calcaneal axis--first metatarsal base angles (TAMBA and CAMBA)

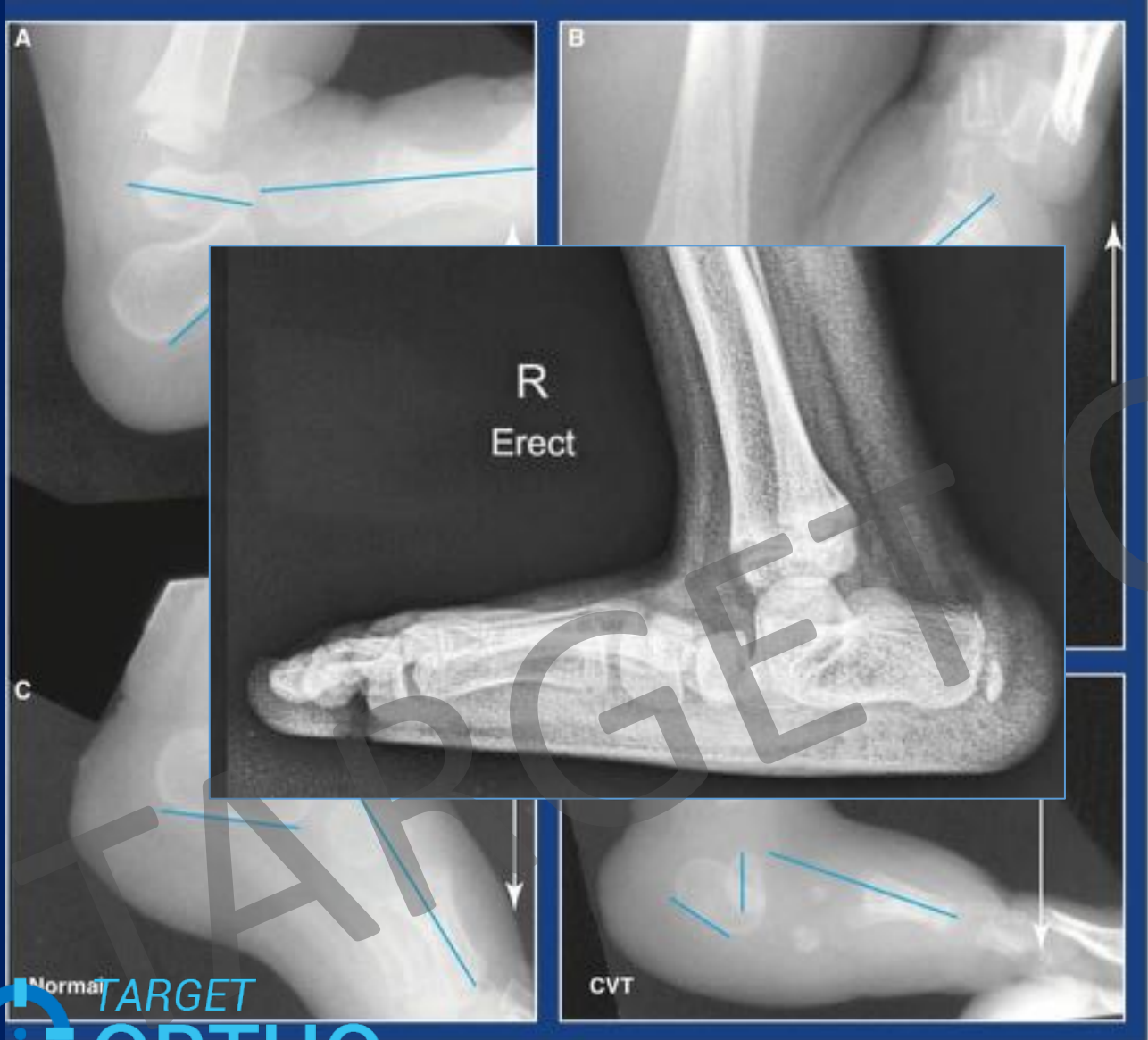
TAMBA $>35^\circ$ $\rightarrow$ Vertical Talus



AP View

- Calcaneus- 4th MT angle – Abduction
- Talo-1st MT angle –(N -10- +30) Eversion
- The talocalcaneal (Kite) angle is normally **20 to 40** in children < 5 years.





Normal

Calcaneum <
Perpendicular
to Tibia

Talus
Perpendicular
to Tibia

Talus-1st MT
Axis collinear

CVT

Calcaneum >
Perpendicular
to Tibia

Talus Plantar

Navicular
Dorsally
dislocated

	CVT	OT	FFF
Talo- 1 st MT angle of PF Stress View	>35*	<35*	<35*
Calcaneum	Locked	Locked	Unlocked
Treatment	TN Joint Reduction	Stretching/ TA lengthening	Reassurance

Ogata and Schoenecker

- Idiopathic,
- With other congenital anomalies but no neurologic deficits
- Vertical talus and associated neurologic disorders

Hamanishi

- (1) Neural tube defects or spinal anomalies,
- (2) Neuromuscular disorders,
- (3) Malformation syndromes,
- (4) Chromosomal aberrations,
- (5) Idiopathic.

Coleman

1. Isolated talonavicular dislocation
2. talonavicular and calcaneocuboid joint dislocations

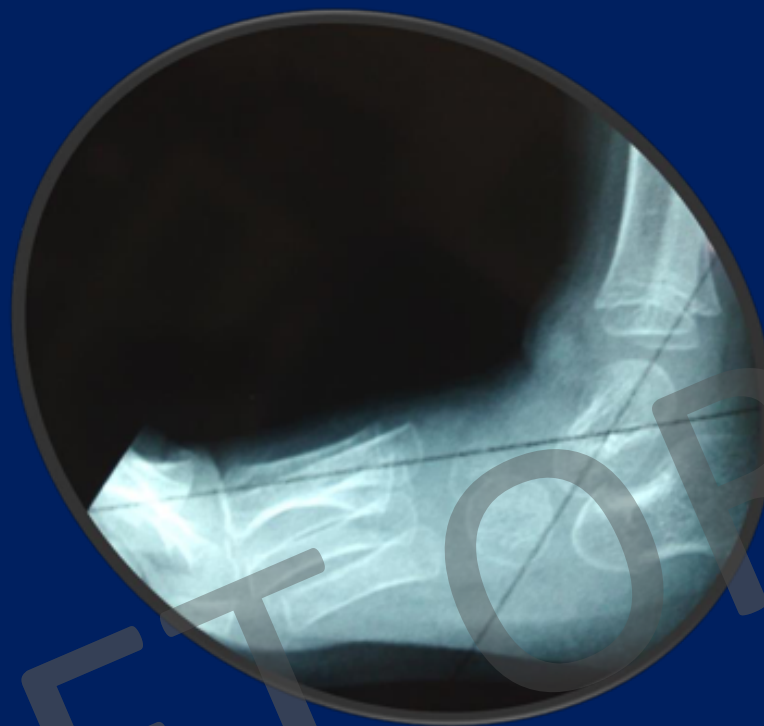
SERIAL MANIPULATION & CASTING BY MATTHEW DOBB'S METHOD



The foot is stretched into **plantar flexion** and **inversion** while counter pressure is applied to the medial aspect of the **head of the talus**



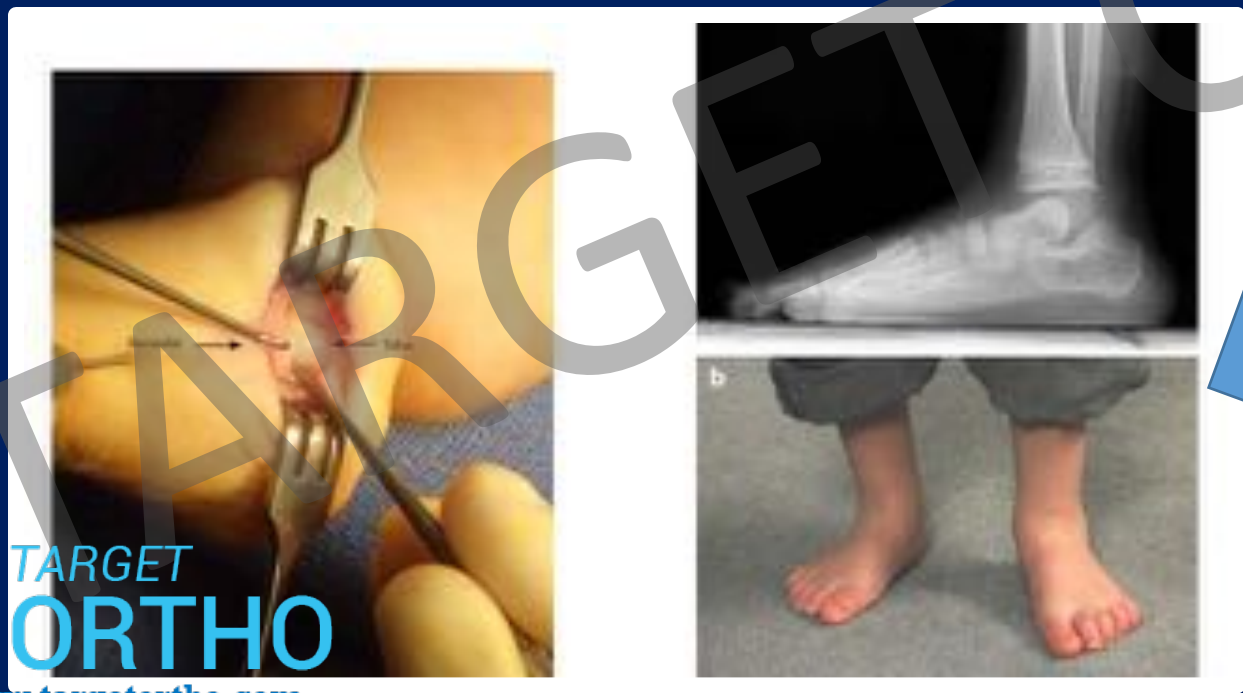
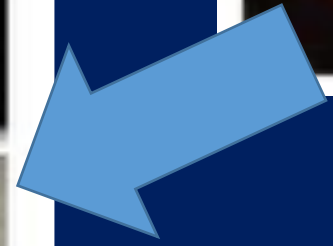
(TAMBA) = 98
degrees



TAMBA AFTER
3rd CAST = 55



TAMBA AFTER
4th CAST = 33





P85: 19_11.05.20

PAT2198

IGICH

KIRAN R

ORTHO

Late Presenting cases

- Grice Green Arthrodesis
- Talectomy
- Triple Arthrodesis

Accessory Navicular Syndrome



Accessory Navicular Syndrome



Mx

- Symptomatic
- UCBL Orthosis
- Cast Immobilization
- Surgical Resection



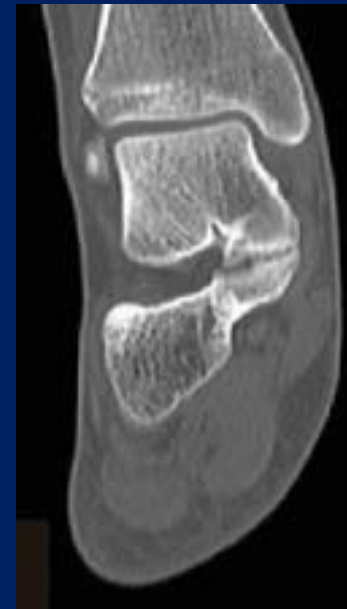
R
Erect

L
Erect

*“A **congenital** foot anomaly that consists of a **fibrous**, **cartilaginous**, or **osseous** connection between tarsal bones.*

Prevalence **2% - 13%** (Canada 1948; Australia 2003)

76% Asymptomatic (Leonard JBJS 1974)



Incidence

Calcaneonavicular > Talo calcaneal

Most Common: Calcaneonavicular > Talocalcaneal.
(90%)

Others: Talonavicular, Calcaneocuboid,
Naviculocuneiform

50 - 60% Bilateral

Pathology

Failure of segmentation in embryonic mesenchyme → fibrous anlage

Autosomal dominant (AD) pattern of inheritance

But phenotypic presentation varies



Syndromic association

- Fibular hemimelia
- Clubfoot
- Arthrogryposis
- Apert syndrome
- Nievergelt-Pearlman syndrome



Effect of Coalition

- Locking and Unlocking – occurs at subtalar joint
- Subtalar Pronation (Eversion) - causes the TTJ axes to become more parallel. (i.e. unlocked)
- Subtalar Supination (Inversion) - causes the TTJ axes to become non-parallel (i.e. locked)



Coalition - foot constantly Locked, constantly rigid

Effect

Rigid Hind foot – Persistently locked

Other joints hypermobile

Resulting in a flatfoot

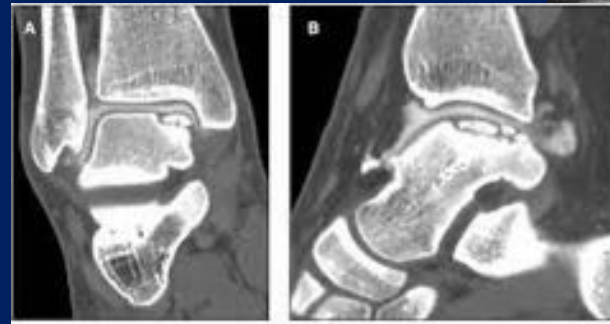
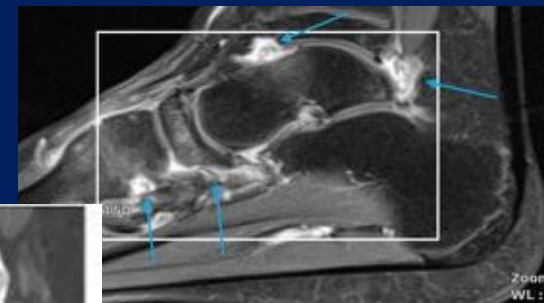
Foot Examination

In Non weight Bearing and
Weight Bearing



Differentials

- Flexible flatfoot
- Tight heel cord
- Inflammatory arthritis
- Osteochondritis dissecans



History

Pain, Increase with activity

No Diurnal variation

Multiple sprains

9-13 CN; Adolescence TC

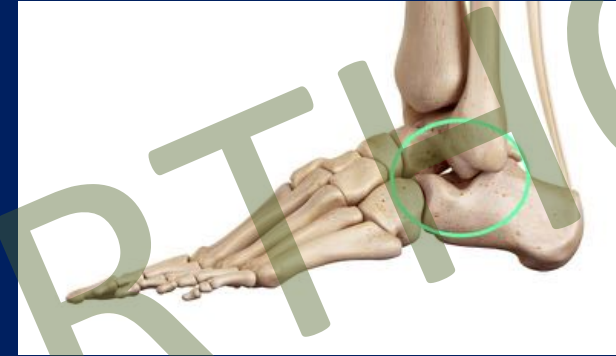
Family history

Clinical Features

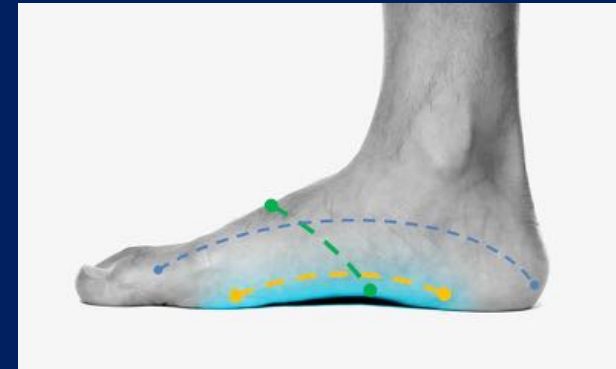
1. Important to examine the deformity
2. Its flexibility and associated joints
3. Head to toe examination

Site of Pain

Sinus tarsi and inferior to the fibula : calcaneonavicular coalition



Distal to the medial malleolus, deep within the subtalar joint, or along the medial aspect of the foot : talocalcaneal coalition





CAVOVARUS: varus hindfoot,
pronated forefoot

FLATFOOT: valgus hindfoot,
supinated forefoot

Forefoot : Supinated,

Midfoot : Abducted

Hindfoot: Valgus,

Ankle :Equinus





Osseous

Chondrous

Fibrous

PEDIATRIC Flatfoot

DIAGNOSIS

(4)

Flexible
Flatfoot
(Pathway #2)

Rigid Flatfoot

Congenital
Vertical
Talus
(Pathway #3)

Tarsal
Coalition
(Pathway #4)

Peroneal Spastic
Flatfoot without
Coalition
(Pathway #5)

Iatrogenic &
Post-
Traumatic
(Pathway #6)

Skewfoot
(Pathway #7)

Other Etiologies
(Pathway #8)

- Neurologic Abnormalities
- Muscular Abnormalities
- Genetic Syndromes
- Collagen Disorders



- Painful, Rigid, Flatfoot

Pediatric Flatfoot – ?Rigid or ?Flexible



+ Restricted Subtalar motion

X-Rays

- Standard Foot Films
 - *Weight Bearing*
 - AP
 - Lateral
 - 45 degree oblique
 - Harris Heel view



Radiology

- Xray Weight bearing View AP, Obl Lateral
- Ct Scan
- MRI (Recently Gold standard)

Ant Eater sign

On lateral- Long
anterior process of
calcaneus

Best view:

- 45 External obl film

Additional signs

- Talar beaking
- Broadening of
lateral process of
talus

Calcaneo navicular Coalition



TaloCalcaneal Coalition

Difficult to see on plain films

C- Sign

Outline of Talar dome and
posteroinferior outline on
Sustenaculum Tali

Complete/ Incomplete
(Mubarak et al)



TaloCalcaneal Coalition

Difficult to see on plain films

Harris view

Beam at 45° i.e. parallel to the subtalar joint middle facet.





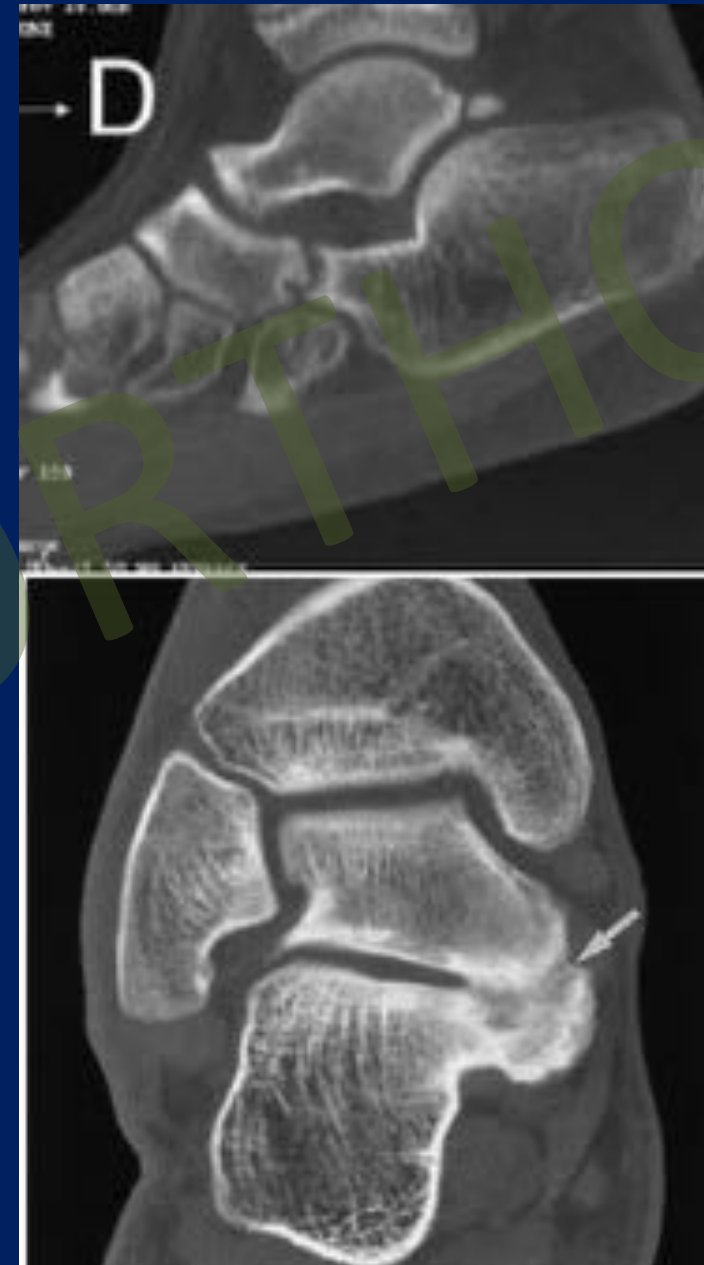
Saltzman Hindfoot alignment View
Saltzman, Iowa, 95

CT Scan

Sagittal for CN Coalition

Helps to rule out other
coalitions (*20% incidence –TSRH*)

Coronal for Talocalcaneal
coalitions



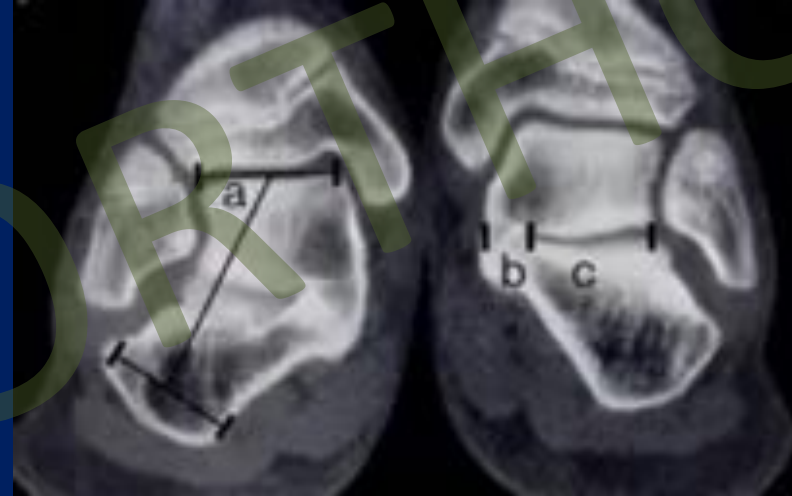
CT Scan

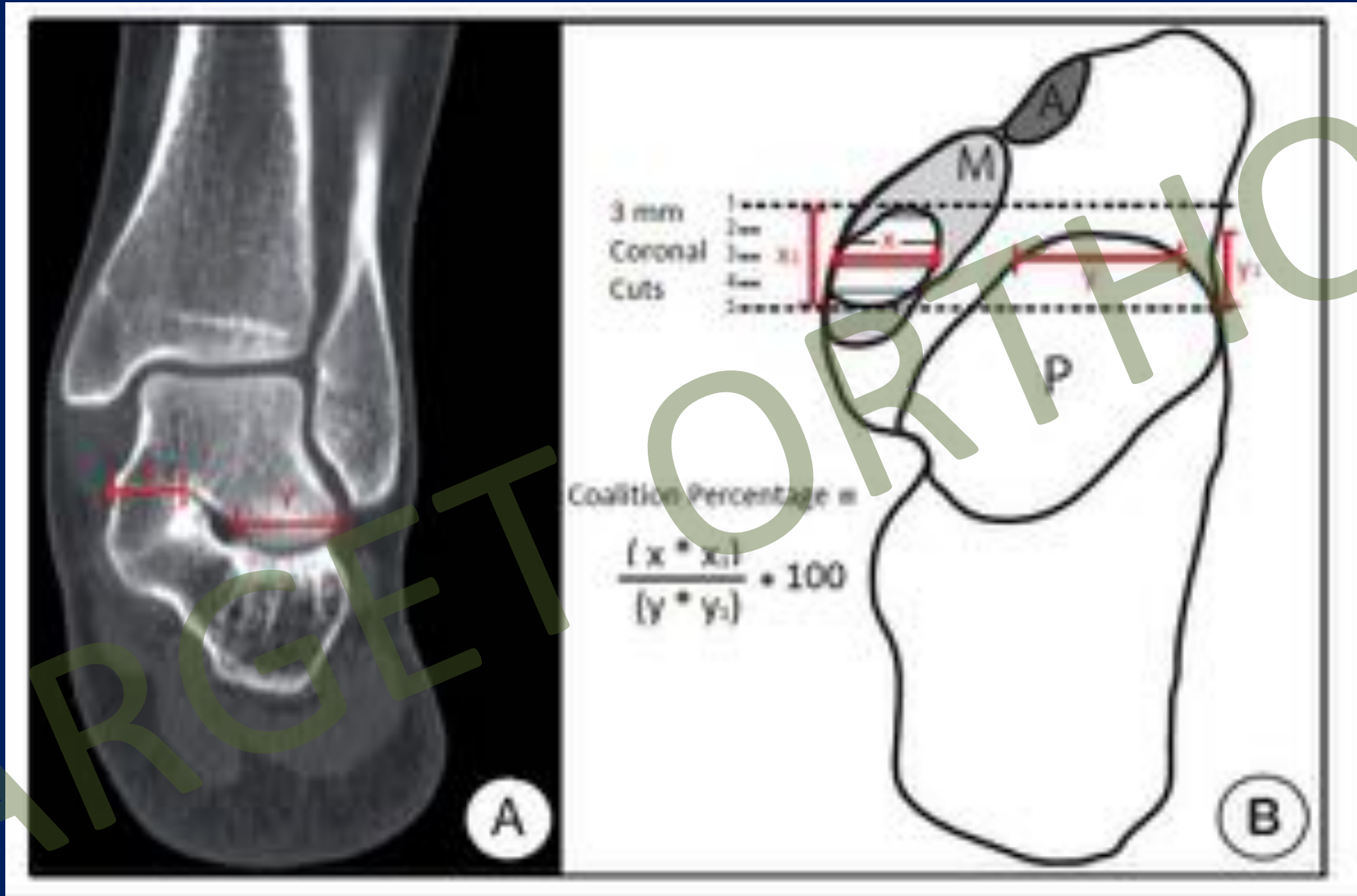
- 16* Valgus, Poor outcome,

Wilde, torode et al

- Surface Area >50% resection, Poor outcome

- Comfortet al, JPO - <1/3 rd



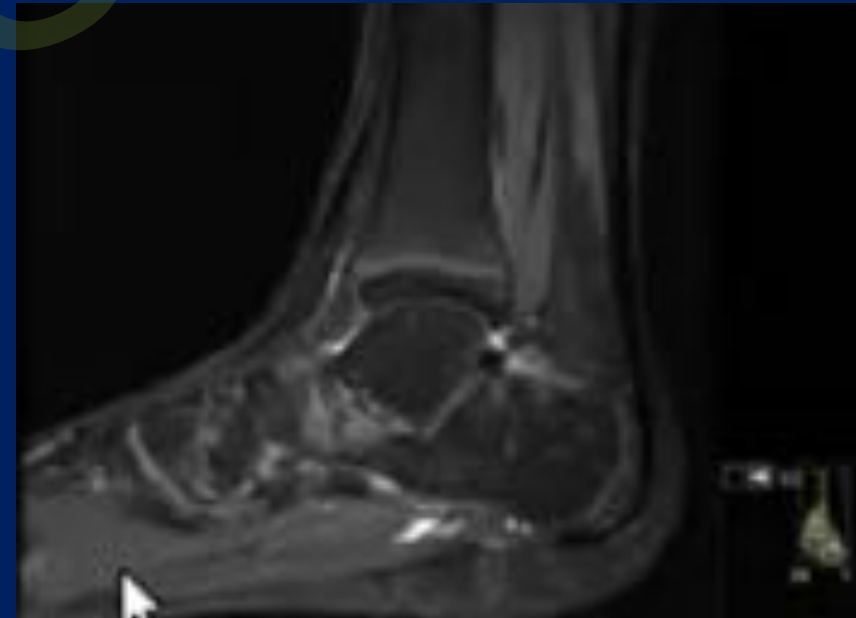
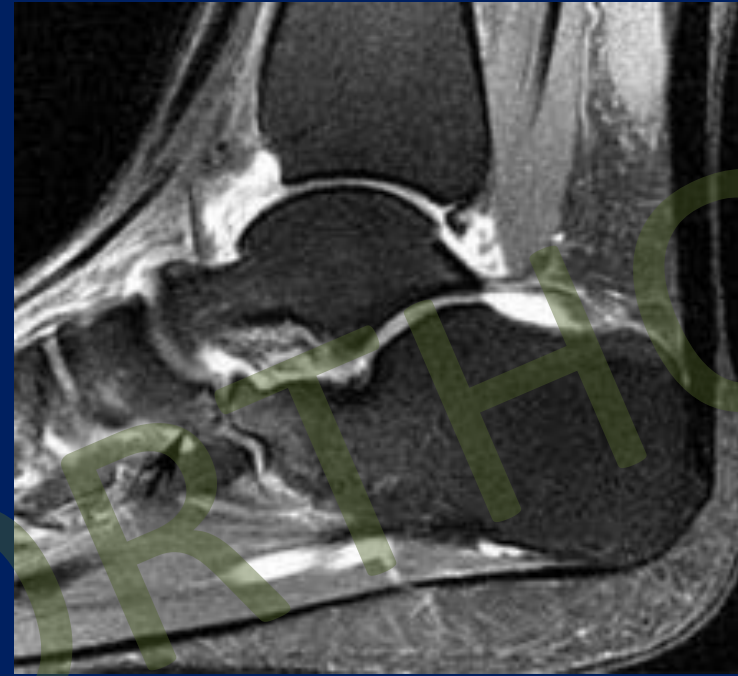


MRI

Fibrous coalitions

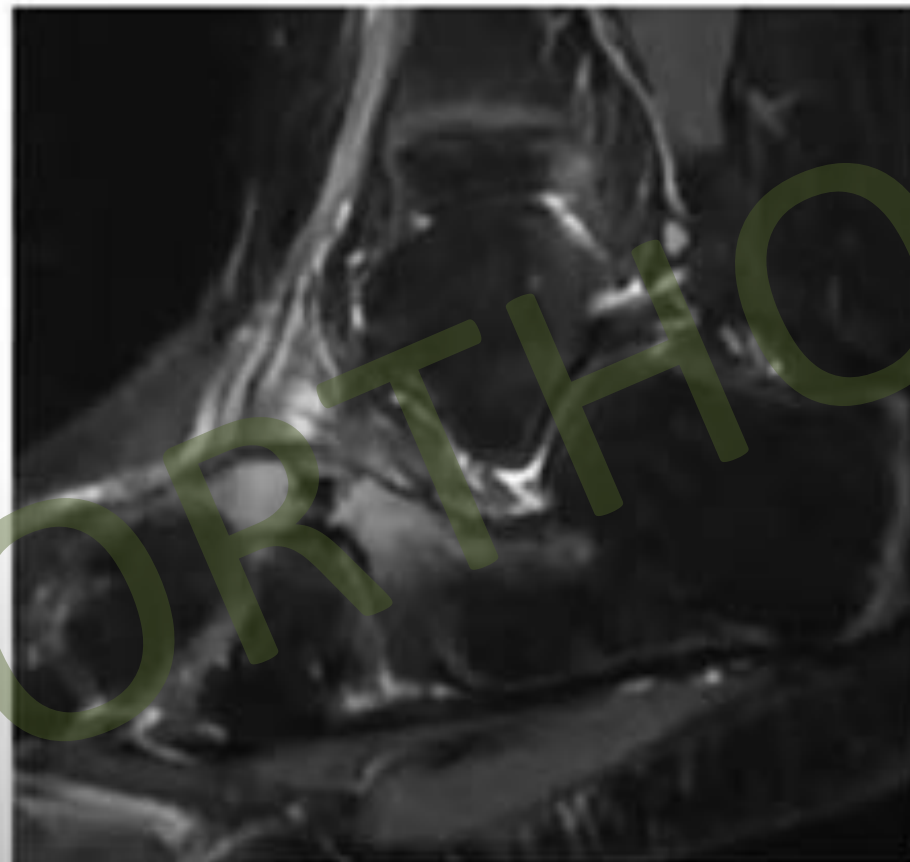
Stress effects surrounding
bones

Status of Cartilage/ Posterior
Facet





PD Fat Sat

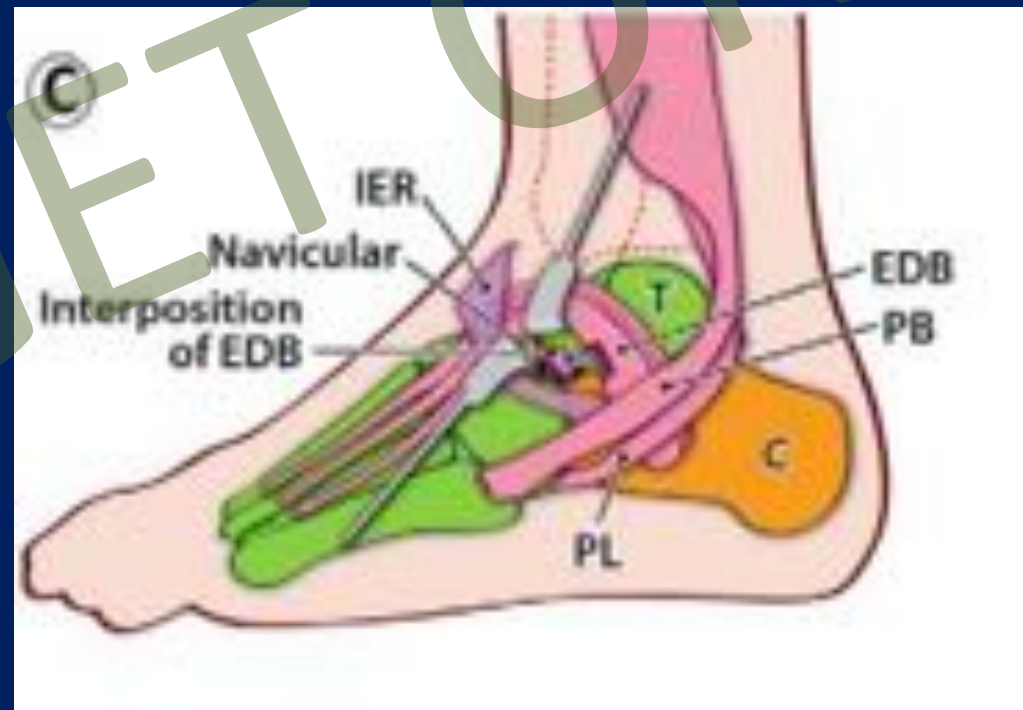
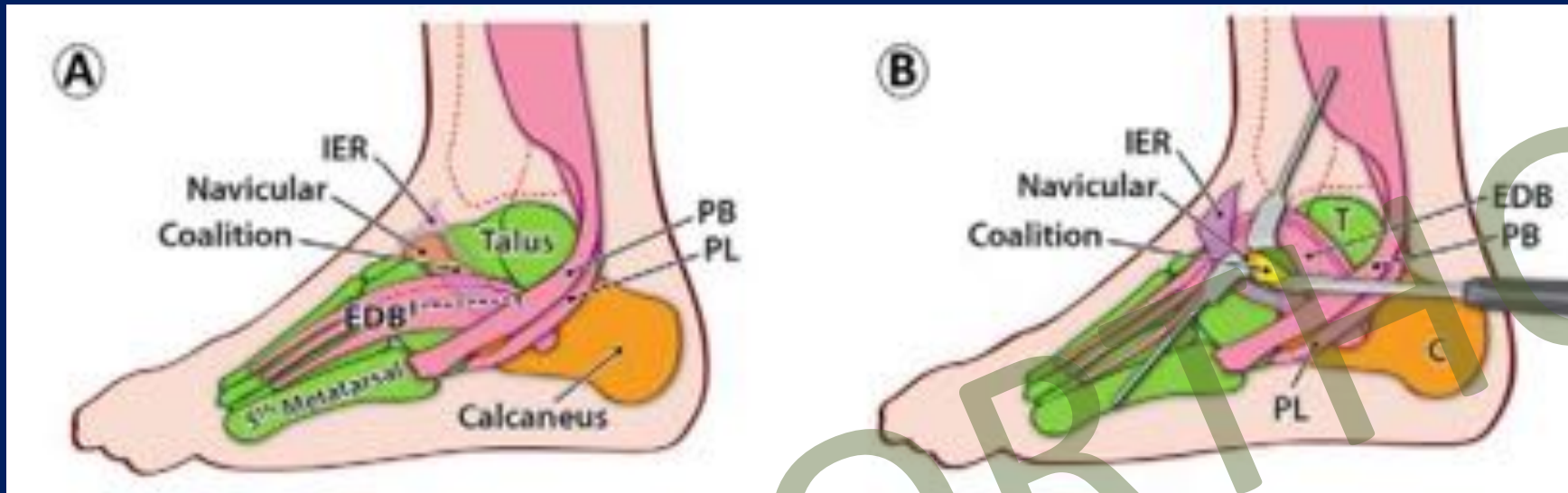


STIR

Mx

Asymptomatic : No Treatment

Symptomatic: NSAID;
Cast Immobilization
Stretching of TA



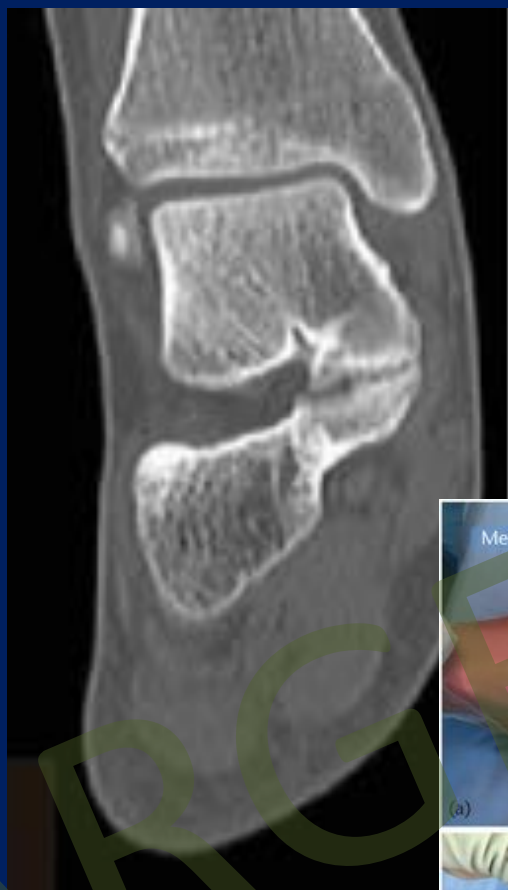
Calcaneonavicular coalition







Talocalcaneal coalition



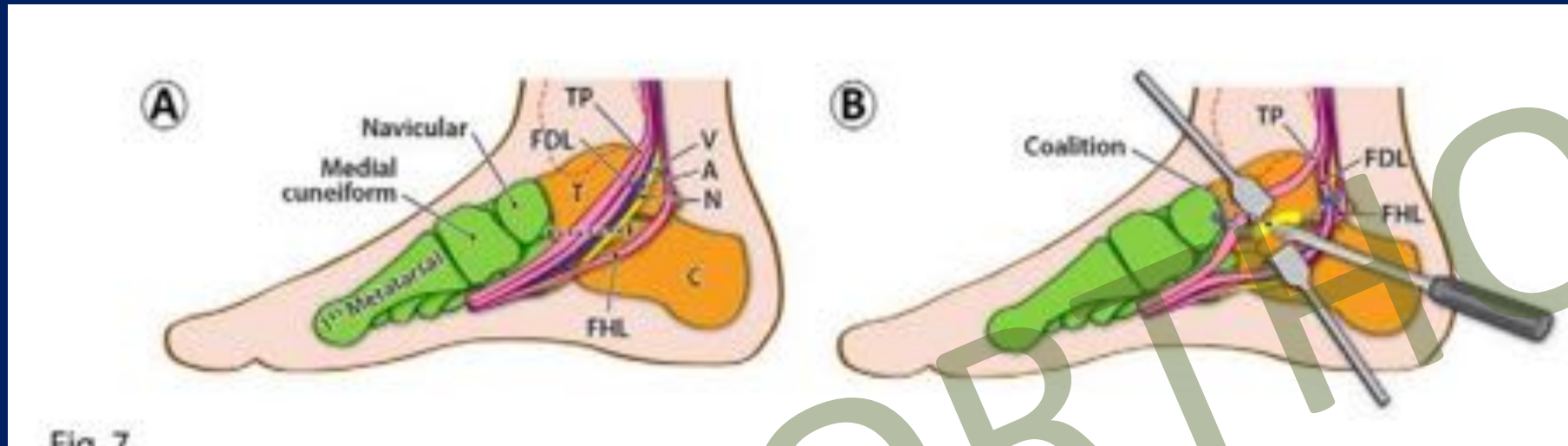
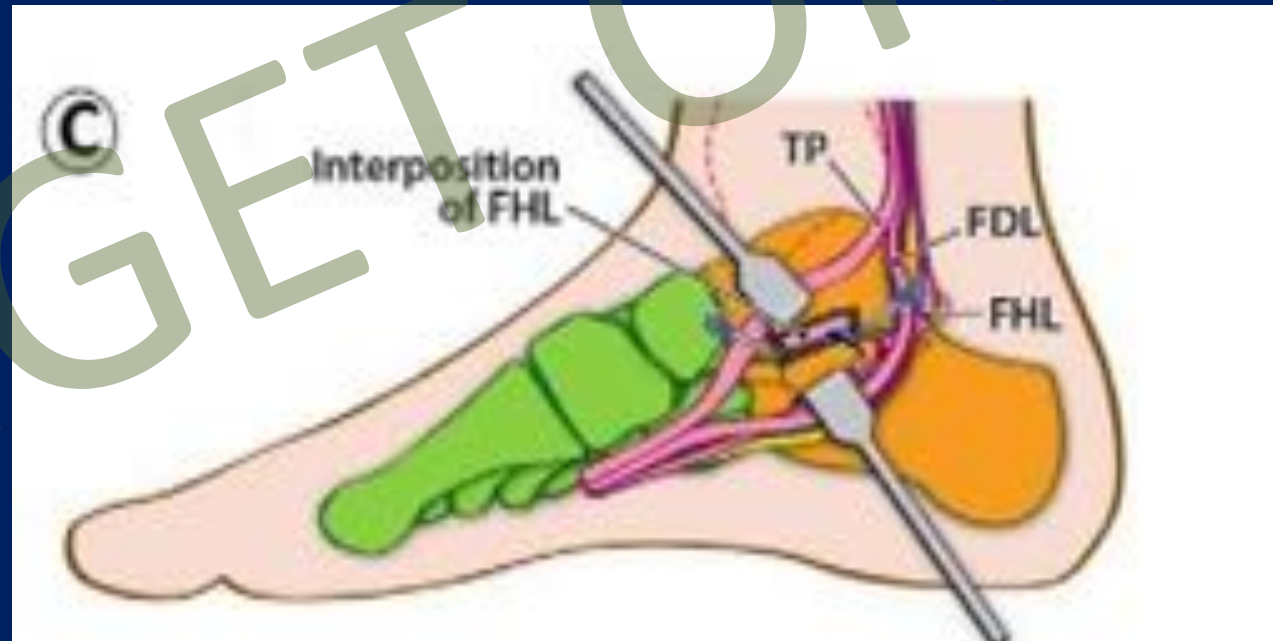


Fig. 7



Talocalcaneal coalition

Not resected alone when

1. Hindfoot Valgus $> 16^{\circ}$

Not resected when:

1. $>50\%$ of facet affected

2. Posterior facet incongruous

Arthritis at Chopart Joint?

No

Yes

Where is the Pain?

At Sinus Tarsi (TC)
Anterior Calcaneal
Process (CN)

Selective
TN
Arthrodesis

Triple
Arthrodesis

No

Yes:
CLO

>16* HF Valgus

No
Alternate diagnosis

Is Coalition Resectable

Yes:
Resect Coalition.
If HF Valgus > 16*
Stages/
Simultaneous CLO

No

Is there >16* Hindfoot valgus?

No
Subtalar
Arthrodesis

Yes
Subtalar arthrodesis with CLO



5 year old boy. Previous surgery 2 years ago. Now recurrent deformity.
K/c/o CTEV

