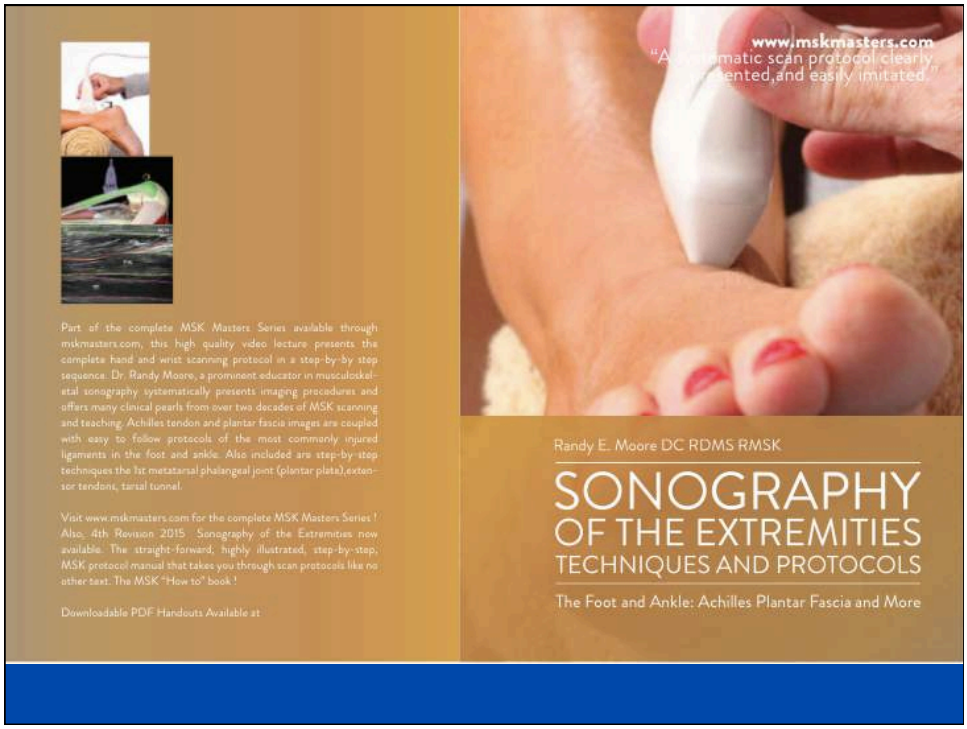


The Ankle and Foot

The Ankle and Foot

"The foot has become one of the most important areas for musculoskeletal ultrasound, rivaling the shoulder for frequency of referral. "

"Many patients present with symptoms localized to particular areas of the foot ,and in these instances ultrasound plays an important role in differential diagnosis."

Eugene G. McNally, FRCR,FRCPI
Consultant Musculoskeletal Radiologist
Nuffield Othopaedic Centre and John Radcliffe Hospitals
Oxford, UK

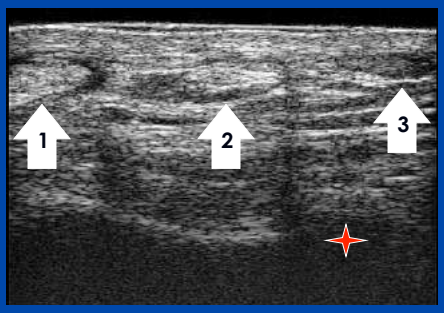
The Ankle and Foot

Ankle : Anterior Transverse

Transverse probe placement at the anterior tibio-talar joint.
Cross-sectional views of the extensor tendons is displayed

EDL= Extensor Digitorum Longus
EHL= Extensor Hallucis Longus
TA= Tibialis Anterior

The Ankle and Foot
Ankle : Anterior Transverse



Supine patient with leg extended or flexed with foot planted on exam table

Visualize the *joint space first*. Long margin of Tibia vs Convex Talar aspect.

1=EDL 2= EHL 3= TA

The Ankle and Foot
Ankle: Anterior Longitudinal (medial of midline)

Long axis probe *medial of midline*.

Extensor Hallucis Longus and Tibialis Anterior are adjacent tendons.
TA is more medial
Passive extension of the 1st digit distinguishes EHL vs TA

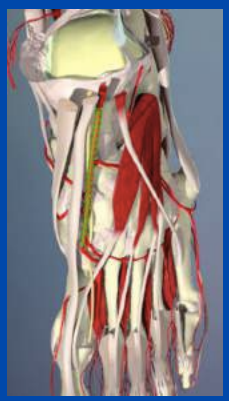
Suggested label: Rt or Lt EHL/ TA long

The Ankle and Foot
Ankle : Anterior Longitudinal (midline)

Long axis probe position *at the midline*.

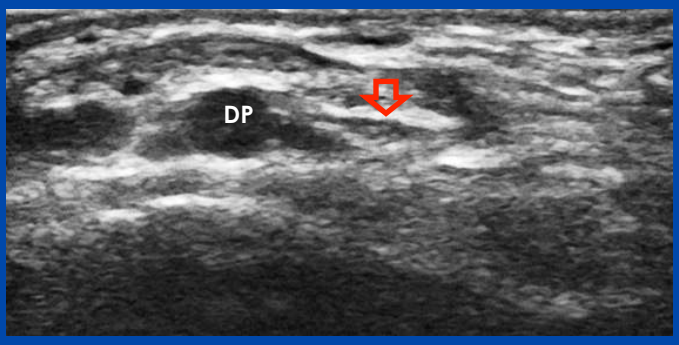
The proximal and thickest portion of the Extensor Digitorum Longus lies directly under the Inferior Extensor Retinaculum, the thinner, hyperechoic interface superficial the tendon.
Passive extension can distinguish EDL vs EHL.

The Ankle and Foot
Deep Peroneal Nerve



The Deep Peroneal nerve lies superficial to the interosseous membrane and…
Medial to the anterior tibial vessels.
The non-compressible… pulsatile Dorsalis Pedis
Also, deep to EHL

The Ankle and Foot
Deep Peroneal Nerve



The fasicular pattern of the small nerve is medial to Dorsalis Pedis (DP) and deep to EHL

The Ankle and Foot

Anterior Ankle Observations

Joint effusion,synovitis

Cortical integrity of tibia & talus
Anechoic hyaline cartilage present ?
Extensor tendons (EDL,EHL,TA) intact ? edematous ?

The Ankle and Foot

Antero-lateral Ankle

Anterior Talo Fibular Ligament

Long axis /oblique probe crosses the joint space

The ligament interdigitates with the deeper, anterior joint capsule and may *APPEAR* to dip into the joint space

The Ankle and Foot

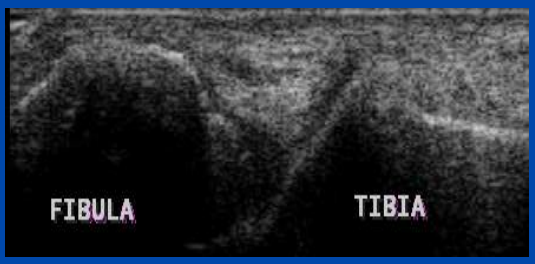
Superior and Medial from the Fibular Malleolus

(Rotating probe to obliquely cross the Tib;Fib)

Previous Image
TALO- FIBULAR LIG

Current Image
TIBIO-FIBULAR LIG
An *INTEROSSEOUS* ligament
Deep to the EDL muscle.

The Ankle and Foot
Anterior TIBIO-fibular Ligament



Probe is positioned on the Antero-Superior aspect of the fibular malleolus, AND turned obliquely enough to have the tibia as the right-side bony landmark.

The Tib-Fib ligament is a *syndesmotic* ligament.

Stabilizing a joint that is normally only "slightly movable".

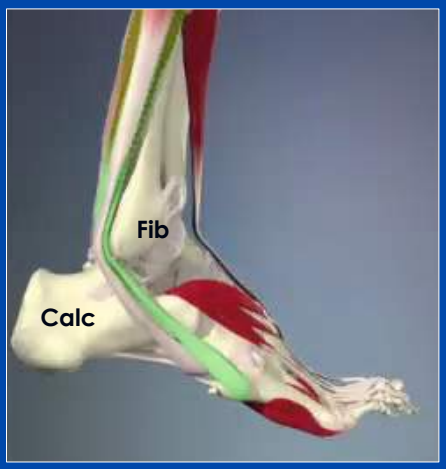
Thus… it is short and thick

Suggested label : Rt or Lt Tib Fib

The Ankle and Foot
Tibio-fibular Ligament

Syndesmotic Injuries…
"High Ankle" sprains
External rotation WITH
Hyper-Dorsiflexion

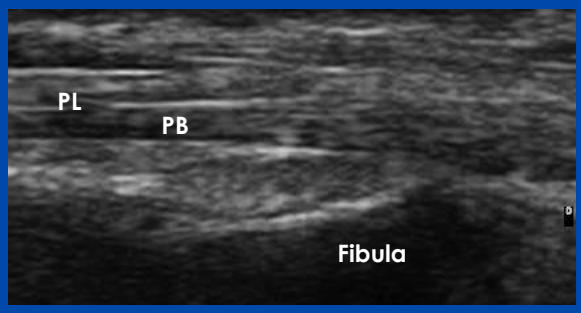
The Ankle and Foot
Posterior to the Lateral Malleolus
The Peroneal Tendons Long Axis Image



Peroneous Brevis (green) is deep… next to bone.
Peroneous Longus (purple) is distinguished by the linear, hyperechoic interface of the two peri-tenons.

The Ankle and Foot
Posterior to the Lateral Malleolus
The Peroneal Tendons Long Axis Image

Prone patient, with the probe posterior to the lateral malleolus



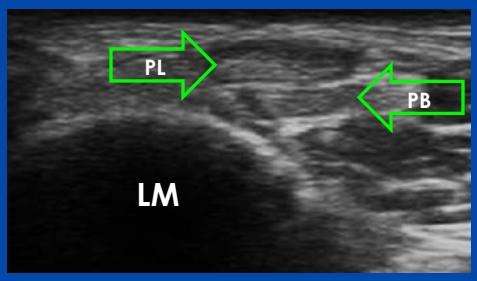
Peroneous Brevis is deep… next to bone
Peroneous Longus is distinguished by the linear, hyperechoic interface of the two peri-tenons.

Suggested label: Rt or Lt Per long

The Ankle and Foot

Posterior to the Lateral Malleolus

The Peroneal Tendons Short Axis Image



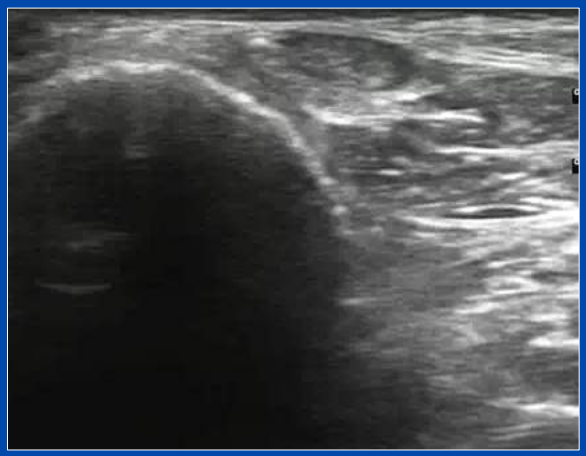
Prone patient…or decubitus
Probe is short axis at the lateral malleolus (LM).
Peroneal tendons are seen in cross-section

Brevis is ***DEEP*** to Longus

Suggested label: Rt or Lt Per short

The Ankle and Foot

The Peroneal Tendons Eversion Stress Image

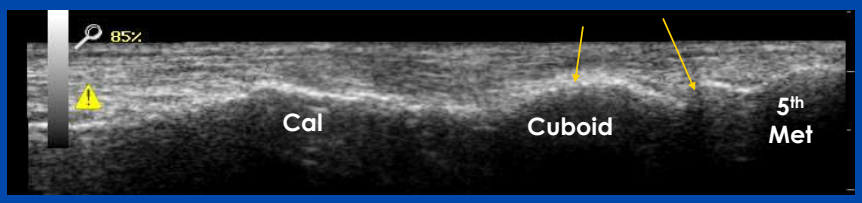


Applying mild eversion stress helps visualize abnormal tendon movement under the retinaculum…
Or within tendon sheath

The Ankle and Foot

Tracing to 5th Metatarsal Head

Forced PB contraction (eversion) accompanied by plantar-flexion-Inversion may cause avulsion fracture of 5th Metatarsal .
(an opposing action)



The Ankle and Foot

Inferior- lateral Ankle
Calcaneo-Fibular Ligament

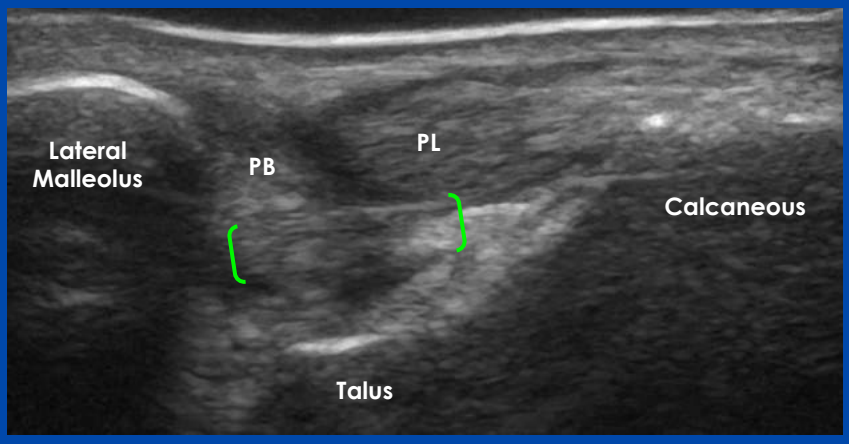
The largest of the 3 lateral collateral ligaments.

Commonly injured as is ATFL

The Ankle and Foot

Inferior- lateral Ankle

Calcaneo-Fibular Ligament

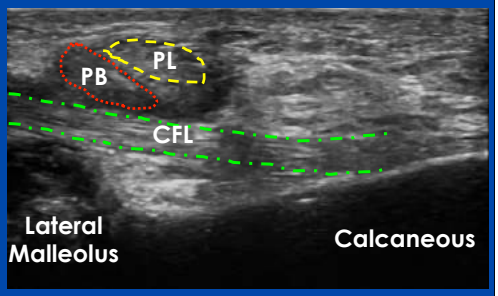


With the foot in (upward) **dorsi-flexion, the CFL is tensioned, and the fibers are more visible.**

The Ankle and Foot

Inferior- lateral Ankle

Calcaneo-Fibular Ligament



A careful downward rotation of the probe from a SAX image of Peroneal tendons is needed for a LAX of the CFL

The Ankle and Foot

Posterior to the Medial Malleolus

Time to meet…

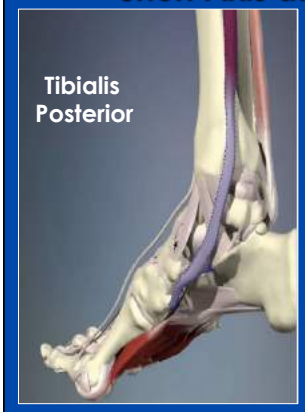
***Tom*: *Tibialis* Posterior**

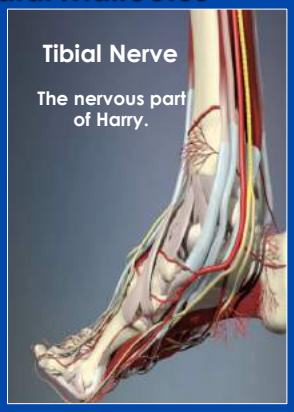
Dick*: Flexor *Digitorum

Nervous Harry*: Tibial *Nerve* and Flexor *Hallucis

The Ankle and Foot

Short Axis at Posterior-Superior Medial Malleolus

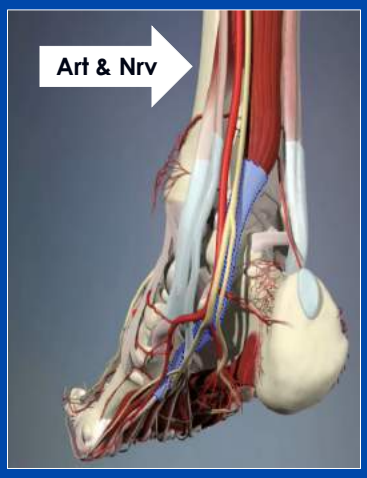




Moving posteriorly from the bony medial malleolus, cross-sectional display of the tarsal tunnel structures is seen

The Ankle and Foot

Short Axis at Posterior-Superior Medial Malleolus

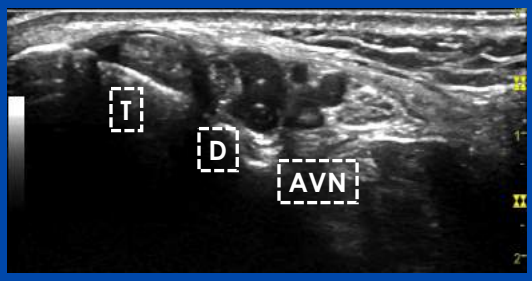


Flexor Hallucis Longus (FHL) is often poorly visualized due it's position deep to Tibial artery and Tibial nerve.

The Ankle and Foot

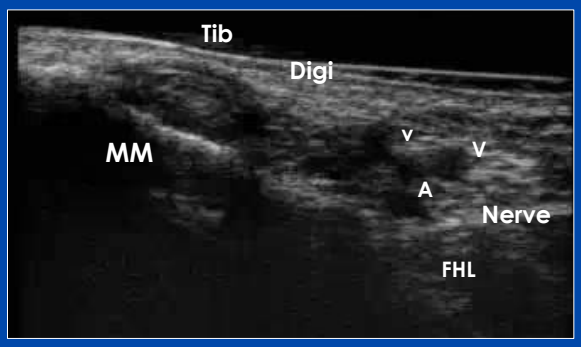
Short Axis at Posterior-Superior Medial Malleolus

Supine patient
External rotation of foot.
Probe in short axis at
or slightly "higher" on MM.



The Flexor Hallucis
(not visible)
is deep to the
artery-vein-nerve bundle

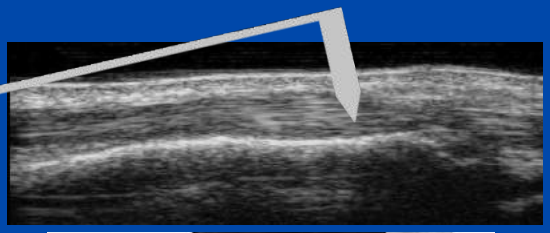
The Ankle and Foot
Medial Ankle/Tarsal Tunnel SAX
Dynamic with FHL



Reading left to right… Tib Posterior is next to malleolus. FDL is adjacent to PT. There maybe two veins with the artery. Tibial nerve is posterior to vascular bundle.

Note! As the poorly visualized (due to anisotropy) Flexor Hallucis is activated the "starry night" appearance of the nerve is better demonstrated.

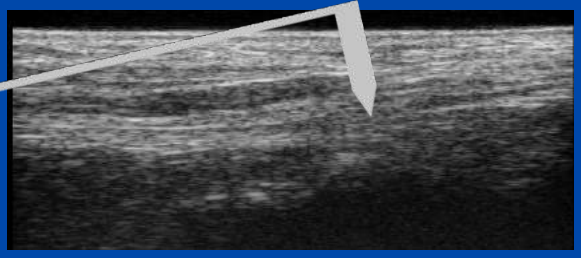
The Ankle and Foot
Posterior Tibial Tendon Longitudinal



Note smooth, intact cortical outline of MM and the quite thick PT tendon.

Suggested label: Rt or Lt PT long

The Ankle and Foot
Flexor Digitorum Longitudinal

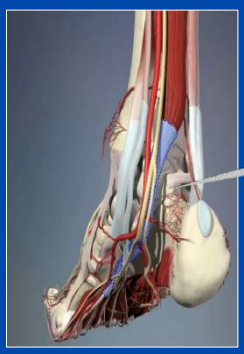


Minimal posterior-ward redirection of the probe is needed to visualize the *deeper* FDL .

Passive flexion of the four lateral digits helps to distinguish

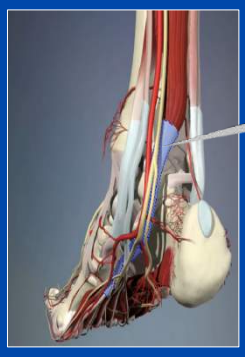
Suggested label : Rt or Lt FDL long

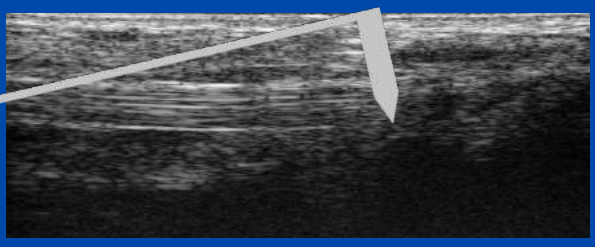
The Ankle and Foot
Posterior Tibial Nerve Longitudinal



Moving the probe *slightly postero- superiorly.*
Visualize the pulsatile artery.
The nerve is seen deep to the artery.

The Ankle and Foot
Flexor Hallucis Longitudinal





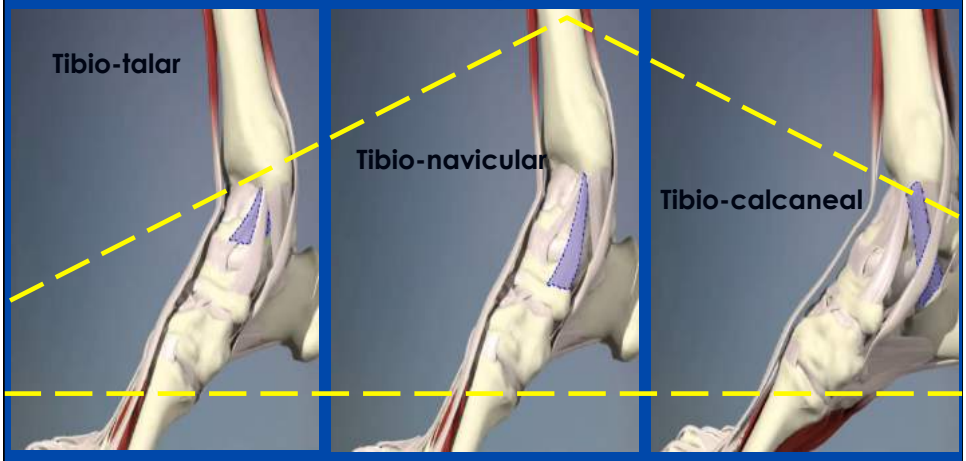
Flexor Hallucis is near Kager's triangle. Move probe posterior from Tibial artery.

The Calcaneous may be seen as a right side bony landmark
FHL is a large, thick, hyperechoic fibrillar pattern.

Manual flexion of the first digit will demonstrate sliding motion of the tendon.

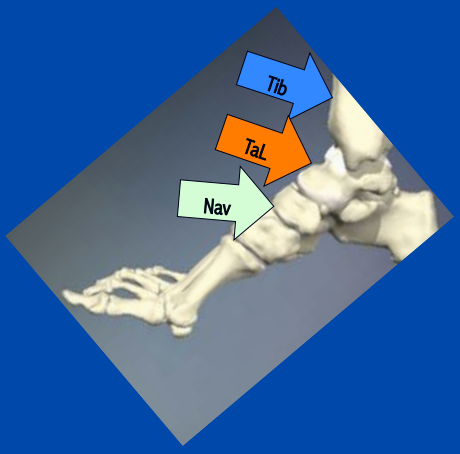
Suggested label : Rt or Lt FHL long

The Ankle and Foot
Deltoid Ligaments



From the word " Delta"… 4th letter of Greek alphabet… Δ
The medial collateral ligaments… 3 in number.
Loosely configured in a triangular contour. Hence the name.

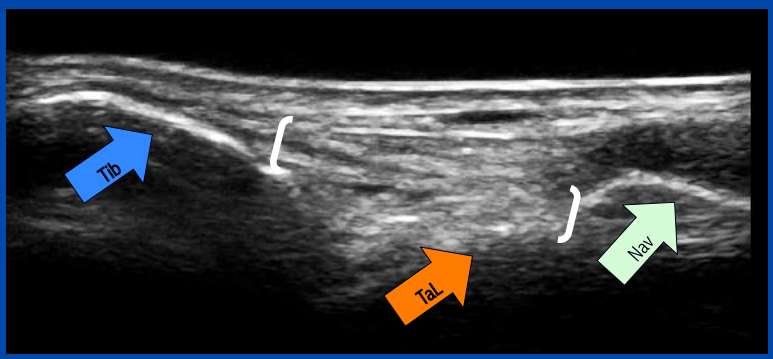
The Ankle and Foot
Deltoid Ligaments



The tibia… talus… and navicular are basically in a linear conformation.

The tibio-talar and tibio-navicular ligaments are often designated as Tibio-talar and DEEP tibio-talar.
Individual distinction is difficult.

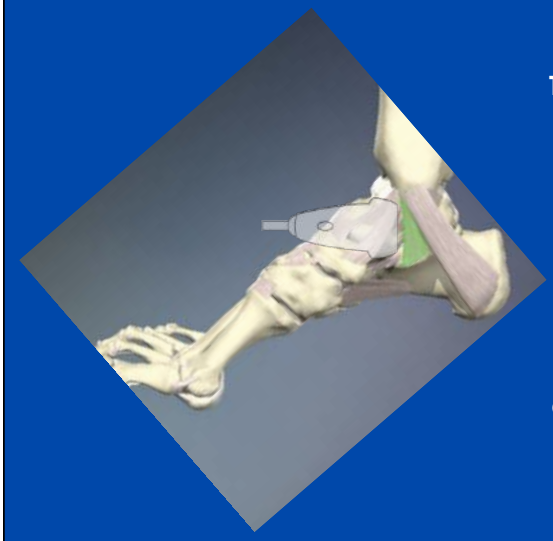
Deltoid Ligaments
Tibio-talar and Deep Tibio-talar Ligaments



Long axis… slightly oblique probe placement
on the antero-medial side of foot.

Tibia… Talus…Navicular bony landmarks are displayed
Homogeneous, fibers of ligaments are deep to bright facsia.

Deltoid Ligaments
Tibio-calcaneal Ligament

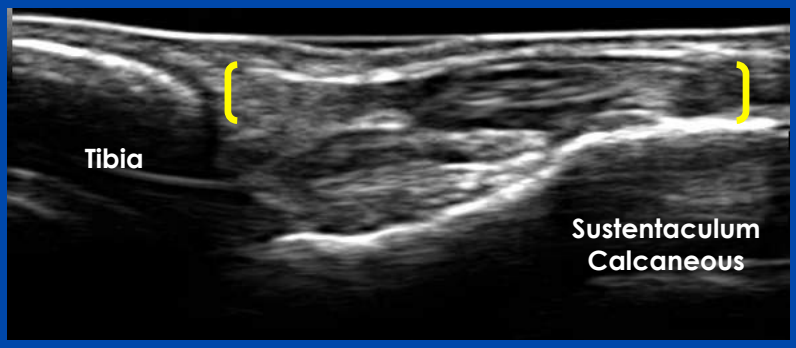


The most inferior and medial of the Deltoid ligaments,

It spans the space between the most distal margin of medial malleolus and the shelf-like projection of the Sustentaculum

Long axis probe placement at the anterior margin of the Medial Malleolus

Deltoid Ligaments
Tibio-calcaneal Ligament



The tibio-calcaneal ligament is deep to the flexor retinaculum

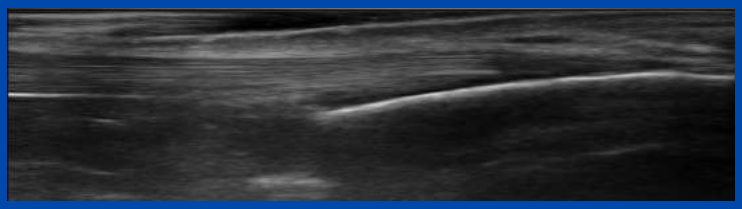
The Ankle and Foot

Achilles Tendon Longitudinal

@ the insertion

Prone patient
LAX probe
ACH tapers to insertion.
Retrocalcaneal bursa deep

Kager's Fat pad
Deeper mixed echoes

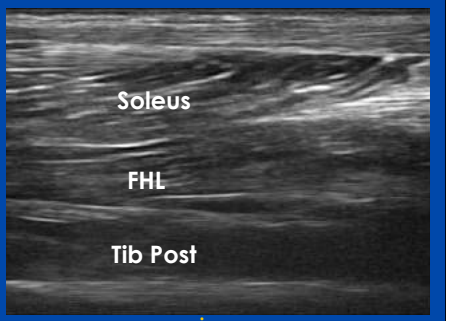


The Ankle and Foot

Achilles Tendon Longitudinal

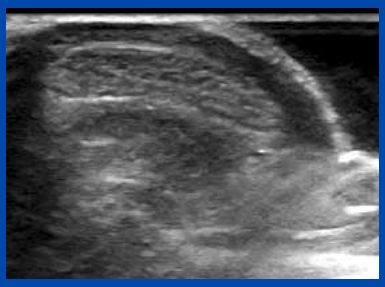
Proximal from insertion @ Calcaneous

Patient prone or kneeling



Most ACH tendon tears occur 6-7 CM proximal from the insertion.

The Ankle and Foot
Achilles Transverse



The ACH is the most superficial.

Patient
prone or kneeling
Probe in short axis.

Normal appearance is
OVOID or
CONCAVE/RENIFORM
on calcaneal margin.

Normal X-sectional thickness
5.5 – 6.5 mm.

Suggested label : Rt or Lt ACH trans

The Ankle and Foot
Saphenous vein and Sural nerve

Saphen or "Safaina" from Greek meaning "clearly seen"

A large subcutaneous vein

Sural…pertaining to the calf or lower leg

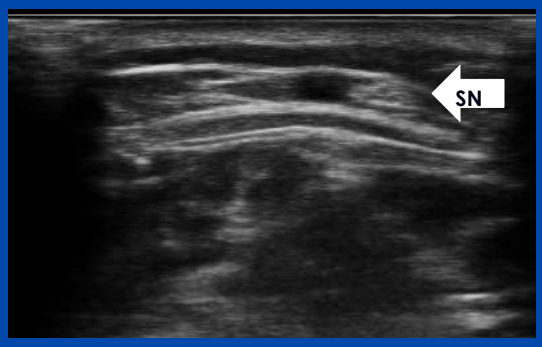
The Ankle and Foot

Saphenous vein and Sural nerve

Using light probe pressure… to avoid compressing the superficial vein

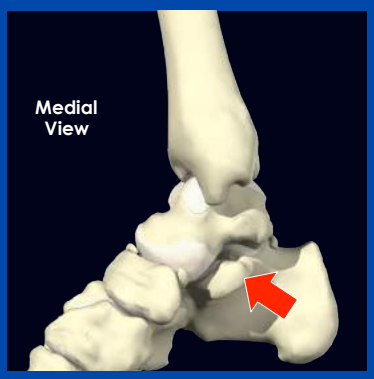
Short axis probe in the mid-gastroc region will first reveal the vein.

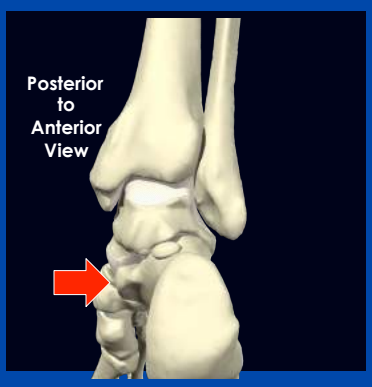
The Sural nerve is adjacent to vein



The Ankle and Foot

Subtalar Joint Medial Approach

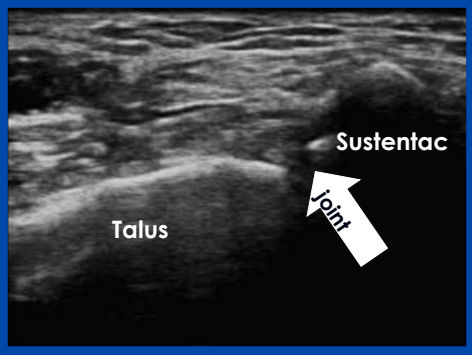




The medial surface of the calcaneous has a shelf-like projection… the sustentaculum . Above is the gentle "arch-like" shape of the Subtalar joint. Manual Calcaneal translation reveals joint space between sustenaculum and talus.

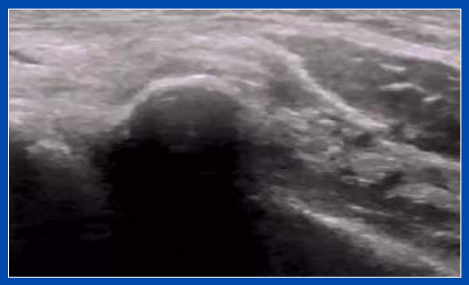
The Ankle and Foot
Subtalar Joint Medial Approach

Probe is in long axis. Left side of Image is proximal External rotation of the foot or having the patient prone with foot extended off the end of exam table may be utilzied.



The talo-calcaneal joint …aka "Subtalar" Flexing the Calcaneous in a lateral and medial plane may help visualize this narrow bony interface.

The Ankle and Foot
Subtalar Joint Medial Approach



Laterally flexing the calcaneous demostrates the subtalar joint and opens the interface for injection.

The Ankle and Foot
Plantar Fascia Longitudinal

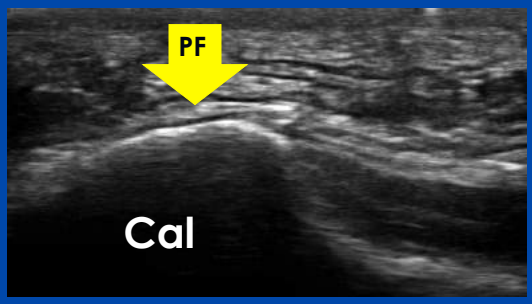
The plantar fascia is a thick fibrous band immediately deep to the fat pad of the foot

A very common site of heel/foot pain due to inflammation

Suggested label : Rt or Lt PF long

Imaging…

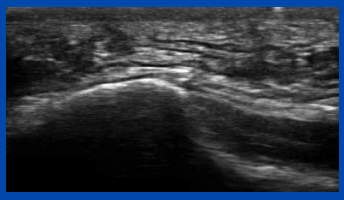
Plantar Fascia LAX

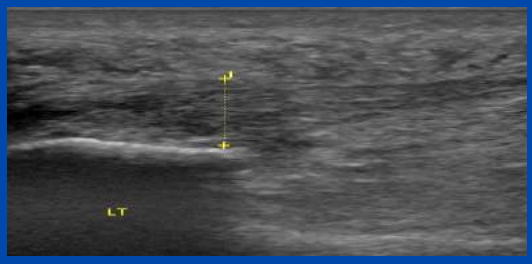


Reading from the cortical outline up:
PF = Plantar Fascia (uniformly fibrillar)
Fat Pad superficial to PF
If musculature is seen deep to PF it is Abductors and flexors of the foot.

There is normally NO BURSA.
Fluid collections are abnormal.

Plantar Fascitis

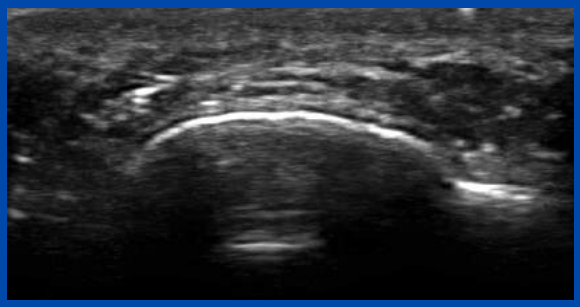




Plantar Fascitis
Measurement is done in long axis by placing the cursor at the apex of The calcaneal convexity, and measuring to superficial /upper interface of fascia.

Normal is 3-4 mm
Distal thickening may occur.

The Ankle and Foot
Plantar Fascia Transverse



Infrequently used to confirm Fascial thickening

Suggested label : Rt or Lt PF trans

The Ankle and Foot
Distal Plantar Foot
Flexor Hallucis and Plantar Plate Longitudinal

Deep
Plantar Plate/
Ligament

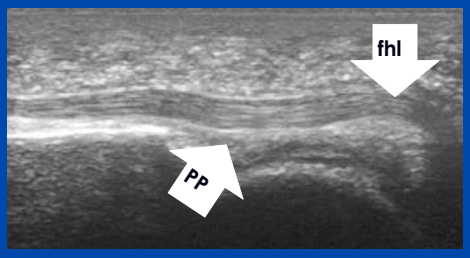
Superficial to PP
Flexor Hallucis

Careful probe
placement
In LAX to avoid
sesamoid bones

The Ankle and Foot
Distal Plantar Foot
Flexor Hallucis and Plantar Plate Longitudinal

Supine patient with long
axis probe position at the
1st Metatarsal Phalangeal Jt.

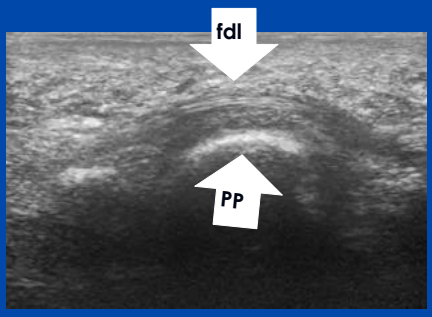
Scanning thru the true midline
of the MPJ does not visualize the
medial and lateral sesamoids



FHL is superficial fibrillar structure.
Plantar plate is ligament deep to FHL.
Joint capsule deep to PP.

Hyperextension injuries can avulse the
Plantar ligament, tearing some of the
Met Head off. Hence, "Plantar plate fx"

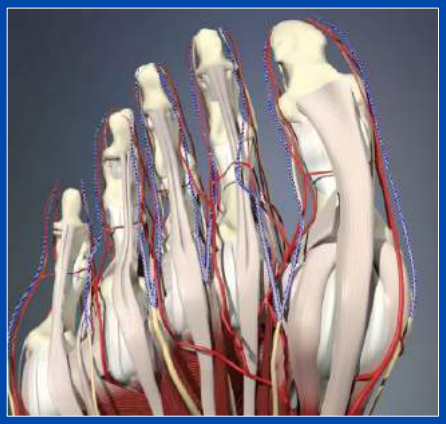
The Ankle and Foot
Distal Plantar Foot
FHL extension: dynamic evaluation for PP fracture



The 2nd MPJ is actrually More common site for PP fracture

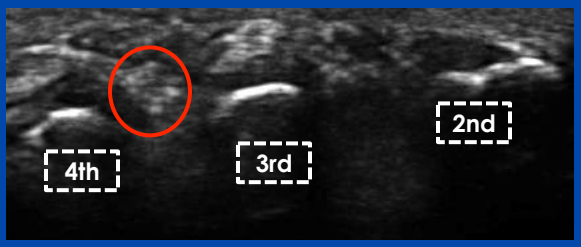
The Ankle and Foot
Distal Plantar Foot Transverse
Interdigital Pain & Neuromas

When assessing interdigital tissue, dorsal compression is useful to detect neuroma and fluid collections



The Ankle and Foot
Distal Plantar Foot Transverse
Interdigital Pain & Neuromas

When assessing interdigital tissue, dorsal compression is helpful.



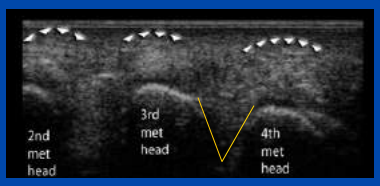
Visualize 2-3 metatarsal heads.

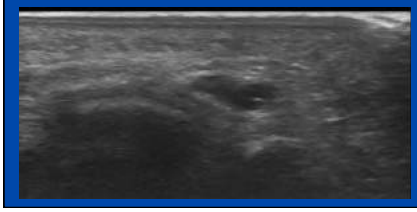
There are 2 compartments in the plantar foot.

Interosseous ligament creates a superficial/ plantar compartment and an interdigital compartment,which has bursa.

May have bursitis w/o neuroma

The Ankle and Foot
Identifying Neuromas





•Note homogenous interdigital echoes from deep transverse and accessory ligaments
* The plantar plate or ligaments are immediately superficial to the joint capsule or above the cortical outline of the met heads.

A hypoechoic ovoid area between the ligament boundaries may be a neuroma.
Anechoic fluid are bursal effusions.

SAX view: Mulder's Maneuver

LAX view
Dorsal or plantar compression may reveal collapse of BURSA.

Neuroma is NOT compressible

Thank you !!