Sonography of the Hip

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Hip Sonography

Equipment Selection: Probe, Frequency (MHz), Depth

- Anterior Capsule
- Ilio-psoas Tendon
- Greater Trochanteric Facets
- Piriformis muscle and Sciatic nerve
- Lateral Femoral Cutaneous Nerve
- Prosthetic Hips
- Femoral Nerve

Hip Sonography

Equipment Selection

- What kind of probe ?

Hips are "deep" structures

And…

Imaging them requires a large acoustic "footprint"

Answer :

Low Frequency (2-5 MHz)… Curved Array

60mm Width

9- 10 cm scanning depth selection is good starting point

Hip Sonography

Probe Selection…options

Linear Probes

Featuring a "trapezoidal" option

There is some limitation:

Acoustic Footprint

Patient Habitus

Frequency (7MHZ Lowest)

Curved Probes

Produce a "sector" image

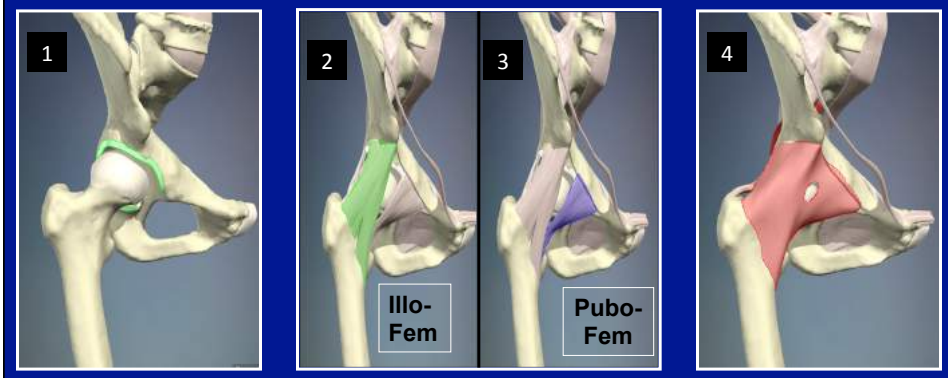
More routinely utilized.

Adequate acoustic footprint

Frequency (3 MHZ)

Anterior Hip Capsule

Hip Anatomy
Anterior Joint : Labrum…Ligaments…Capsule



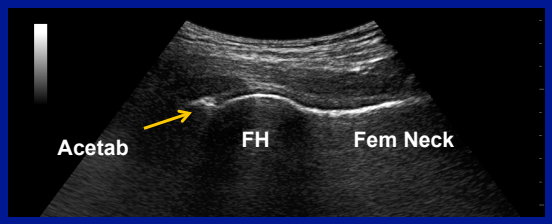
(1) Acetabular Labrum : a ring of fibrocartilage attached to bony rim

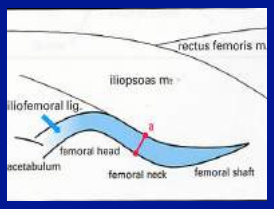
(2) Ilio-Femoral and (3) Pubo-femoral Ligaments: a "condensation"' of the (4) capsule membrane… for joint stability

Hip Sonography

Anterior Longitudinal Approach

Sonographic Anatomy: Bony Landmarks

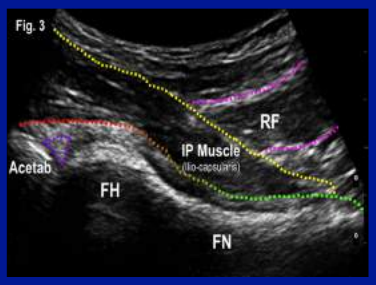




Supine patient . Neutral position.
Only slight external rotation

Hip Sonography

Anterior Longitudinal: "Capsular Contour"



Supine patient .
Relaxed external foot rotation
to expose the anterior capsule

Probe obliquely LAX
Parallel with Femoral Neck

Bony landmarks:
Acetabulum
Femoral Head
Femoral Neck

Hip Sonography

Anterior Longitudinal Approach

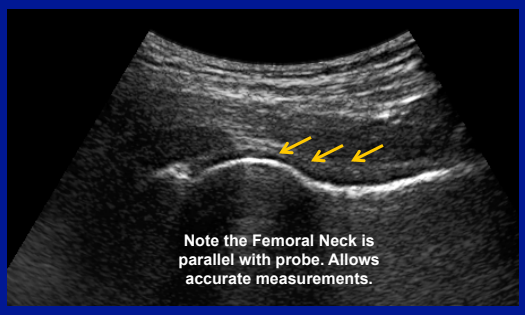
Sonographic Anatomy: Intra vs Extra Capsular Structures

INTRA-capsular

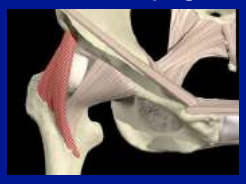
Ilio-femoral ligament
Pubo-femoral ligament

These are LARGE intra-capsular ligaments ! Bone-to-Bone Hyperechoic/bright, fibrillar pattern is normal.

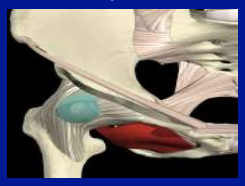
**Identifying landmark for hip capsule



Intra-cap lig



Extra-cap Bursa



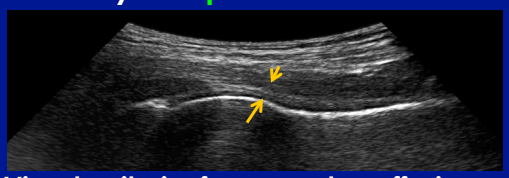
Hip Sonography

Anterior Longitudinal Approach

Sonographic Anatomy: Capsular Effusion

1. Identify bony landmarks FIRST !

2. Visualize INTRA-capsular ligaments as a CONCAVE ,linear band following the contour of the femoral neck. Normal



Visual criteria for capsular effusion

CONVEX /ROUNDED appearance of the combined ligament/capsule complex.
ie : distention/effusion

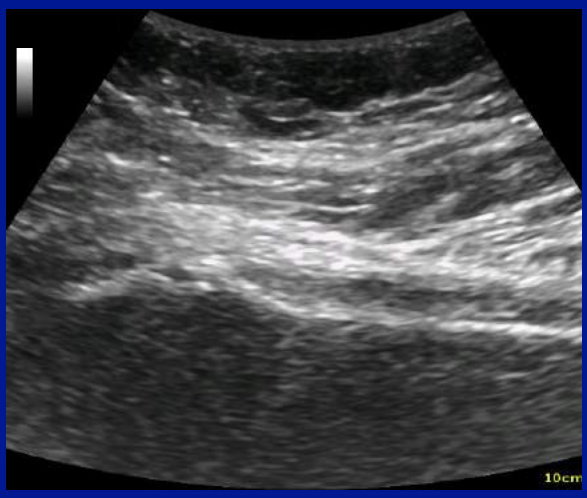
Average thickness at the middle of the femoral neck concavity is 5.2 mm.
Pathologic limit of 8-9 mm

Smaller Effusions:
Comparative Analysis w/ contra-lateral hip should not be more than 1-2 mm difference

Hip Sonography

Anterior Longitudinal Approach

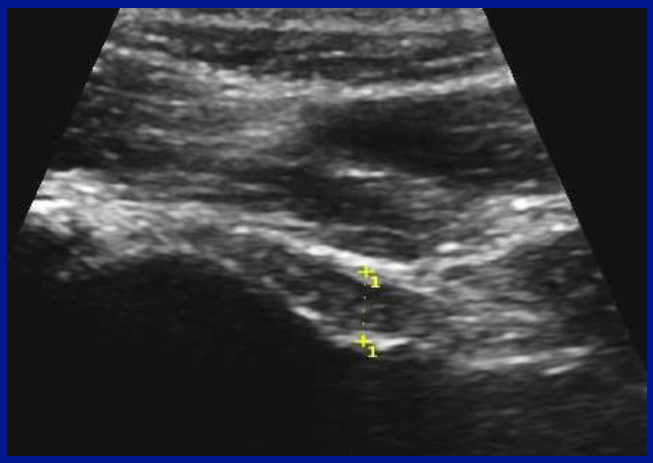
Sonographic Anatomy: Capsular Effusion



Hip Sonography

Anterior Longitudinal Approach

Sonographic Anatomy: Capsular Effusion



Hip Sonography

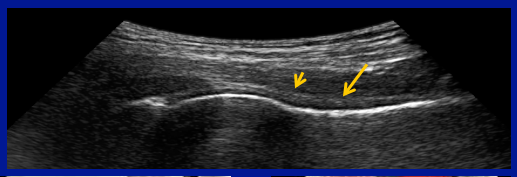
Anterior Longitudinal Approach

Sonographic Anatomy: Extra-Capsular Effusion/Bursitis

1. Identify bony landmarks FIRST !

2. Visualize Extra-capsular muscles as hypo-echoic/darker structures superficial to the capsule.

3. Bursa lies between the capsule and the musculotendinous portion of the ilio-psoas



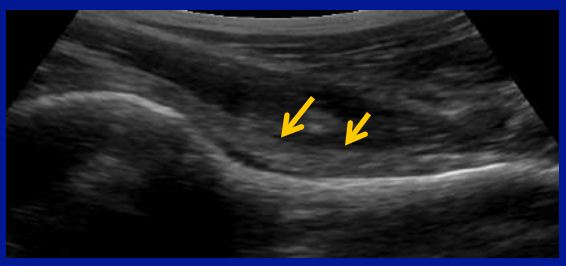
Bursa superficial to capsule

Overlying Musc-tendon of Ilio-Psoas

Hip Sonography

Anterior Longitudinal Approach

Sonographic Anatomy: Extra-Capsular Effusion/Bursitis



Hip Sonography

Anterior Longitudinal Approach

Sonographic Anatomy: Capsular Effusion vs Bursitis

What's the difference ?

Key Point : Isolated Bursitis ***Will Not*** Distend Hip Capsule

Keep Bony Landmarks Crisp, Distinct On Image
Read Image From Cortex to Skin

Doing So Will Enable Distinction Between Effusion or Bursitis..
Or Both !

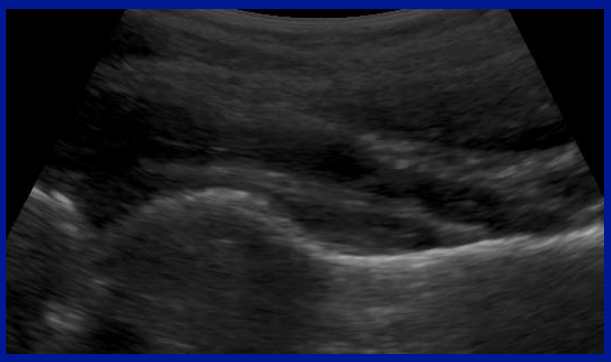
Hip Sonography

Anterior Longitudinal Approach

Sonographic Anatomy: Capsular Effusion vs Bursitis

What's the difference ?

Doing So Will Enable Distinction Between Effusion
or Bursitis.. Or Both !



Hip Sonography

Anterior Longitudinal Approach

Capsule Injection : Static Image

In plane injection.

Needle Advancement is DISTAL to PROXIMAL

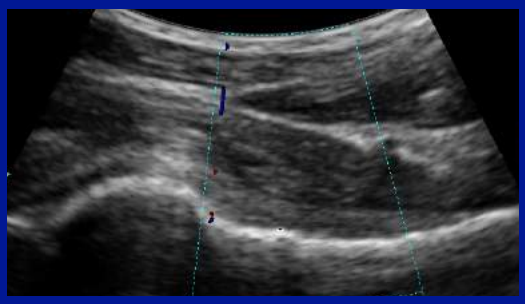
Femoral Artery should not be seen unless the probe is much too MEDIAL.

Tissue "Bounding" or movement may be observed.

Hip Sonography

Anterior Longitudinal Approach

Confirm a clear path to target interface



Needle Advancement is DISTAL to PROXIMAL

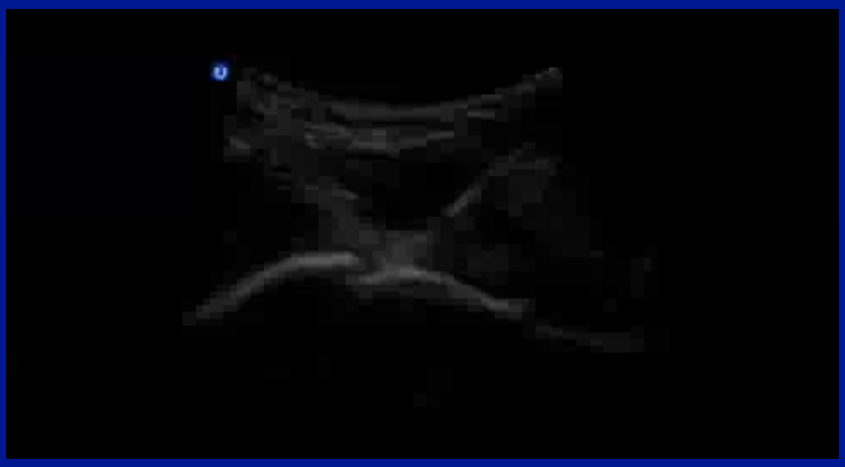
Utilize (non-directional)Color Doppler.

Place sample area in anticipated needle path.

Hip Sonography

Anterior Longitudinal Approach

Capsule Injection

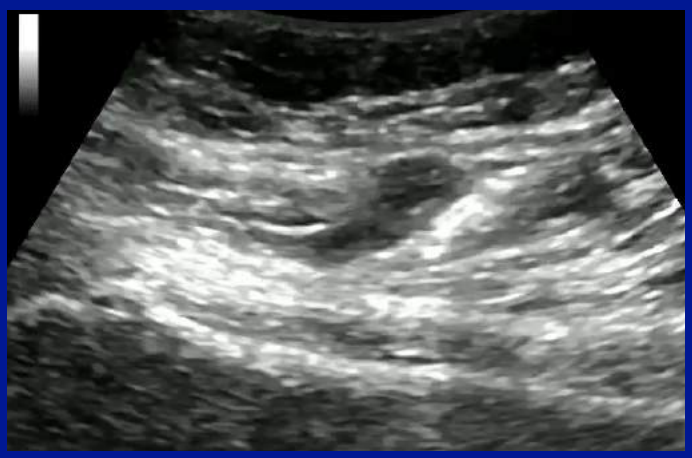


Hip Sonography

Anterior Longitudinal Approach

Capsule Injection: Poor Needle Visualization

Tissue movement can help guide placement

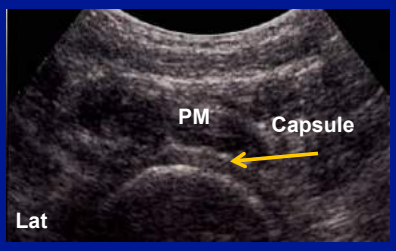


Hip Sonography

Anterior Transverse Approach

Sonographic Anatomy

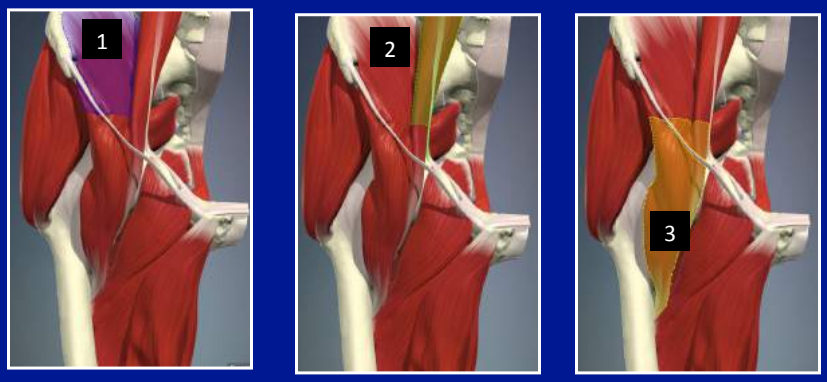
Ant TRANSVERSE Hip
20 degrees
oblique



The capsule presents as a smaller target on short axis because the full length of the capsule is not visualized

Ilio-Psoas Tendon

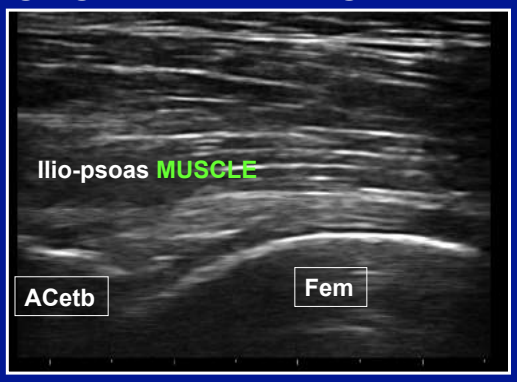
Hip Sonography
Anterior Hip: Ilio-Psoas Tendon



A combination or… conjoined tendon of the (1)iliacus (purple)…and (2) Psoas Major (green).
(2) It crosses joint (superficial to the capsule), attaching on

(3)inter-trochanteric line/femur… as does the capsule

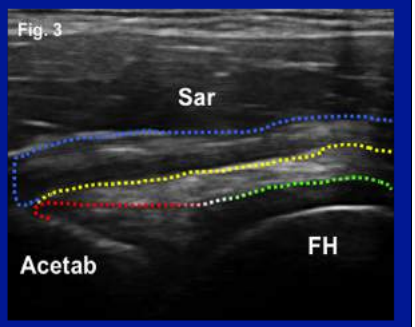
Hip Sonography
Ilio-Psoas Tendon Imaging Protocol: Long Axis



Medial probe translation/rotation from capsular-labrum image becoming parallel with hyperechoic fibrillar tendon.
Septated , hypoechoic IP muscle
is superficial to tendon

Right hip : counter-clockwise Left hip : clockwise

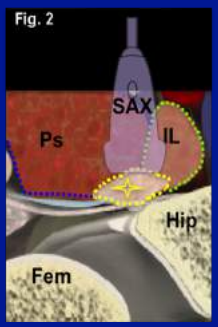
Hip Sonography
Ilio-Psoas Tendon Imaging Protocol: Long Axis

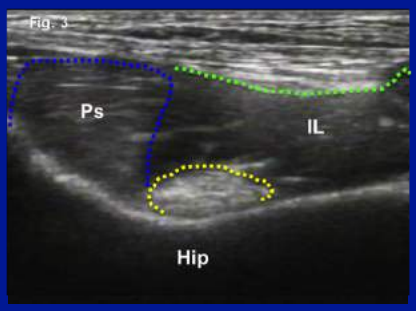


Medial probe translation/rotation from capsular-labrum image becoming parallel with hyperechoic fibrillar tendon. Septated , hypoechoic IP muscle is superficial to tendon

Right hip : counter-clockwise Left hip : clockwise

Hip Sonography
Ilio-Psoas Tendon Imaging Protocol: Short Axis

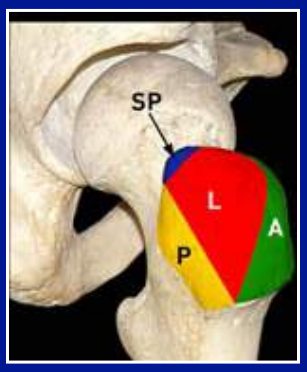




From long axis image , rotate probe into short axis position to be perpendicular to the femur. The dense , hyperechoic tendon is displayed as "ovoid to oblong" adjacent to pubic rim/pectineal line.

Trochanteric Facets

Hip sonography
Gluteal Attachments : Four Trochanteric Facets



Anterior : Gluteus Minimus

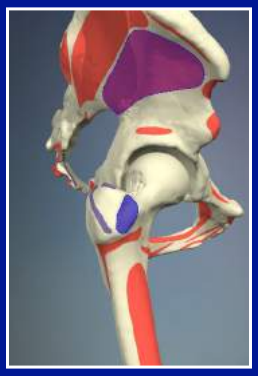
Lateral : Gluteus Medius

Superior-posterior : Gluteus Medius

Posterior: Sub-Gluteus Maximus
(not the attachment)

Hip Sonography

Gluteal Attachments : Anterior Facet – Gluteus Minimus



Anterior Facet : Gluteus Minimus
Arises from the ilium (purple) and attaches on the anterior facet (blue). It is deep to Gluteus Medius . Minimus and Medius together aBduct and internally rotate the hip

Hip Sonography

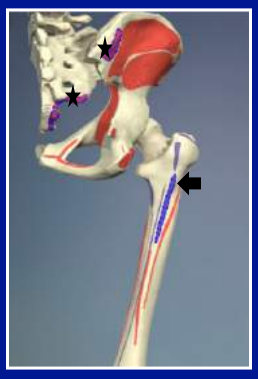
Gluteal Attachments : Lateral Facet – Gluteus Medius



Lateral Facet : Gluteus Medius
Arises from the outer… more superficial ilium (purple) and attaches on lateral facet (blue). Combines with Minimus to aBduct and internally rotate. Keeps the trunk upright when opposite foot is raised.

Hip Sonography

Gluteal Attachments : Posterior Facet … Sub - Gluteus Max

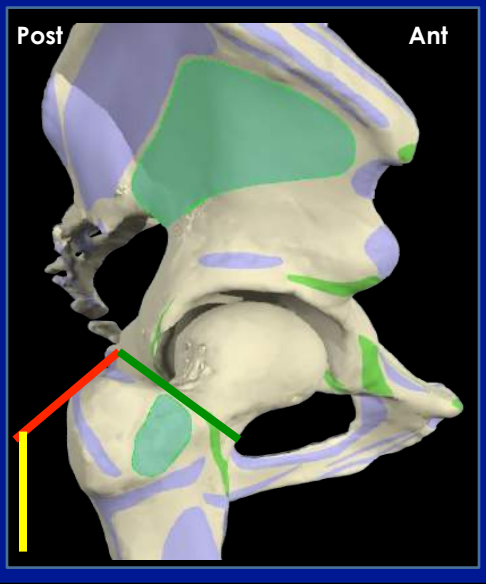


Posterior Facet : Sub-Gluteus Maximus
Gmax :Two point s of origin (1) posterior iliac crest and (2)sacrum/coccyx
Inserts via a long/broad attachment on the gluteal tuberosity of the femur . Extends and laterally rotates hip.

Hip Sonography

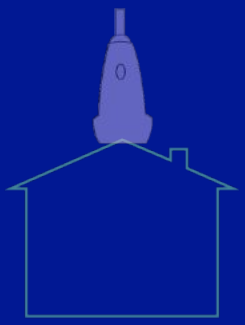
The 3 Facets of the Greater Trochanter

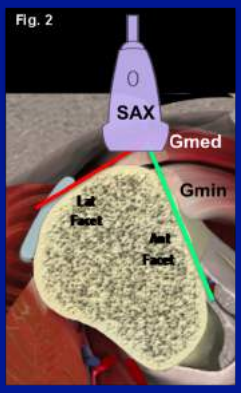
1. Anterior
2. Lateral
3. Posterior



Hip Sonography

Find the "Peak of the roof"

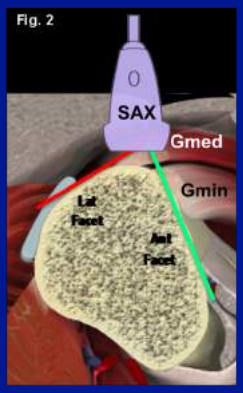


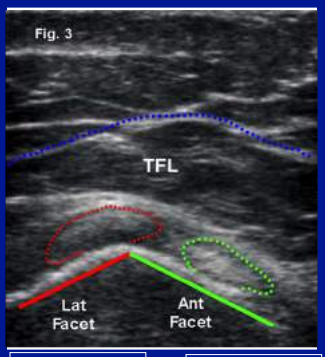


Patient in decubitus position.
Translate/slide the probe proximally and distally
until the sharpest peak of the bony trochanter is visualized

Hip Sonography

Gluteal Attachments Imaging Protocol : Short Axis





(2) Gmed (1) Gmin

Short axis probe placement
at apex/peak of the Greater Trochanter.
Cross-sectional view of Gluteus Minimus and Medius

Hip Sonography

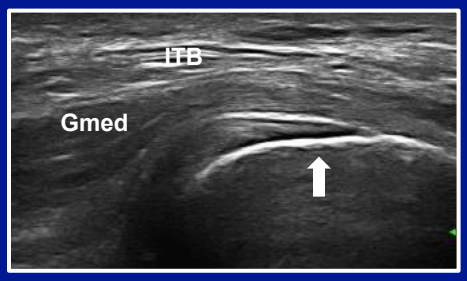
Isolating Gluteus Minimus and Gluteus Medius

Translating / "heel-toe" the probe in an Anterior to Posterior direction allows more specific visualization of the… Minimus and/or Medius.

Rotation into Longitudinal Axis
Beam angle A to P on Anterior Facet for Gluteus Minimus
Beam angle P to A on Lateral Facet for Gluteus Medius

Hip Sonography

Gluteal Attachments Imaging Protocol: Gmin Long Axis



Decubutis patient position . Long axis probe angled A to P
The Gmin tendon is thin and the enthesis is well visualized.

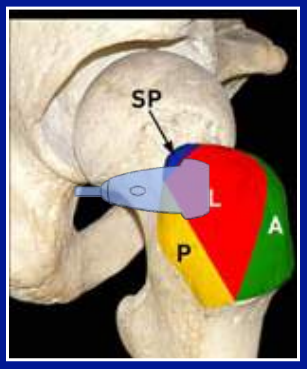
Remember Gmin is deep to Gmed

Hip Sonography
Gluteal Attachments Imaging Protocol : Gmed Long Axis

Proximal Distal

Decubutis patient position with long axis probe angled P to A .

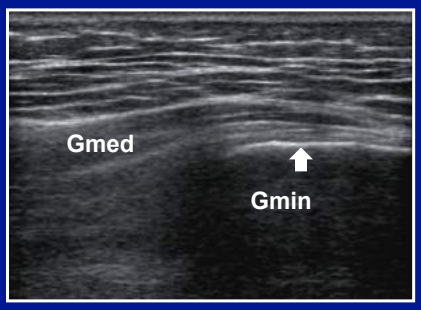
Hip Sonography
Gluteal Attachments Imaging Protocol : Gmax Long Axis



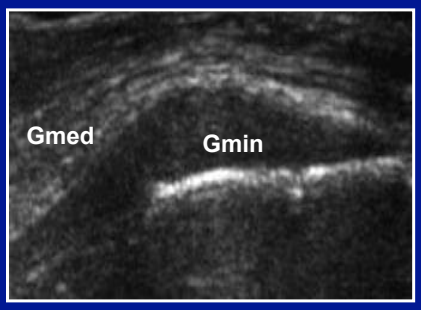
Proximal Distal

Decubutis patient position with long axis probe angled P to A at Posterior facet … sub-gluteal space of Greater Trochanter
Anechoic fluid visible in the Trochanteric Bursa

Hip Sonography
Gluteal Attachments Tendinosis: Gmin Long Axis



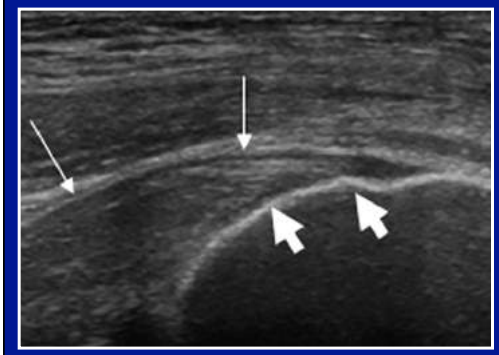
Normal



Abnormal

The tendon is hypoechoic… thickened with poorly displayed fibrillar pattern.

Hip Sonography
Gluteal Attachments Tendinosis: Gmed Long Axis



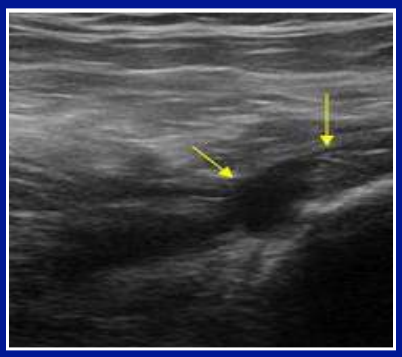
Normal

Abnormal

The tendon is hypoechoic… thickened with poorly displayed fibrillar pattern.

Hip Sonography
Gluteal Attachments Tendinopathy: Gmed Long Axis

Normal



Abnormal

Gluteus Medius tendon rupture

Hip Anatomy and Physiology
Trochanteric Syndrome

-Routinely involves only Gmin and Gmed

- Trochanteric Bursitis … rare

-If fluid is seen typically "simple fluid"
(anechoic with no debris)

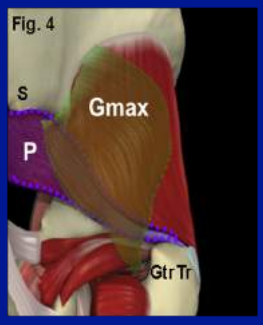
Piriformis/Sciatic Nerve

Hip Sonography

Piriformis Imaging

Probe Position #1
At Grtr. Troch
SAX to femur

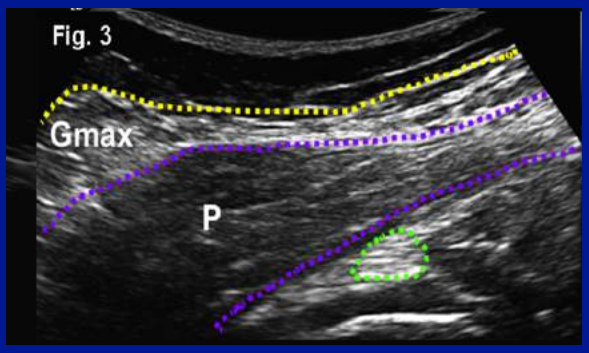
Probe Position #2
Medial into Gmax
Rotate , align w/ Piriformis



Piriformis deep to Gmax

Probe Position #1
The "reference" end of the probe on the posterior aspect of the Greater Trochanter.

Hip Sonography
Piriformis Imaging



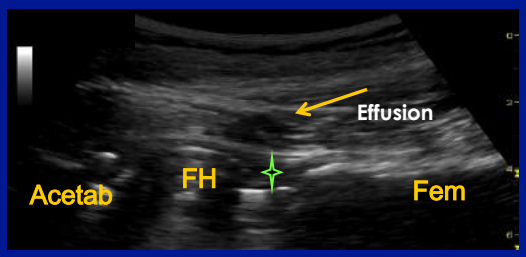
Sciatic Nerve immediately deep to Piriformis
Usually… may pierce the muscle

Dynamic Maneuver : Internally/Externally rotate the hip/foot. Piriformis contracts/slides. Overlying Gmax stationary.

Prosthetic Hips

Hip Sonography

Prosthetic Hip Imaging : Anterior Longitudinal View



The moderately hyperechoic, linear band of the normal pseudo-capsule following the cortical outline is seen as distinct from the overlying iliopsoas muscle

Acetabulum : blunt / rounded

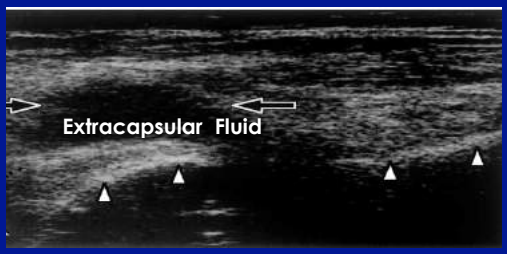
FH: Outline shorter due to reduced circumference

= perceived "Gap" between prosthetic head and femoral cortex

Hip Sonography

Prosthetic Hip Imaging : Anterior Longitudinal View

Post –Arthroplastic Pain



Post arthroplastic hip pain is commonly due to mechanical loosening, but sepsis has similar symptoms.

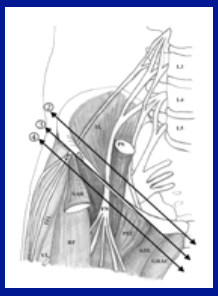
Loosening = repair Sepsis = replacement.

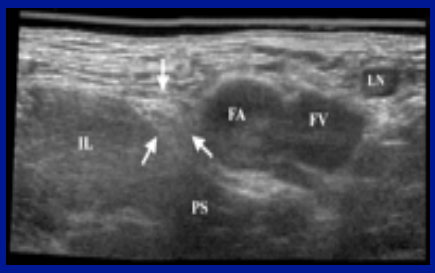
"Intracapsular" fluid may indicate loosening

"Extracapsular" fluid has been correlated to infection

Femoral Nerve

Femoral Nerve Sonography



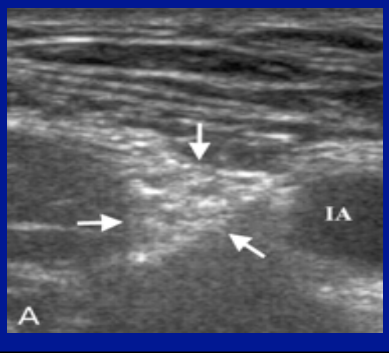


IL= iliopsoas
PS= psoas muscle
FA= femoral artery
FV= femoral vein
LN= lymph node (not typically seen)

Femoral Nerve Sonography

Best seen at the inguinal level.
Usually a triangular shape as it sits in the groove formed by the IS and PS

Average value: medio-lateral diameter 9.8 mm
cross-section 21.7 mm



Lateral Femoral Cutaneous Nerve Sonography

Meralgia Paresthetica…
"thigh pain with anomolous/irregular perception"

Chronic neurologic disorder due to entrapment/ compression at the level of the ASIS and Inguinal ligament

Seen with…
weight gain
diabetes
"seat belt" injury
repetitive motion

Lateral Femoral Cutaneous Nerve Anatomy

Has an oblique path thru inguinal region medial to lateral toward the ASIS.

***Distal** to ASIS….*

• LFCN passes under the Inguinal ligament
• and is "sandwiched" between two layers of fascia … superficial to the Sartorius muscle

ASIS

Inguinal Ligament

LFCN

Sartorius

Lateral Femoral Cutaneous Nerve Sonography

Interface Identification

LFCN is visualized between 2 hyperechoic fascial layers

•Fascia Lata : Superficial "sheath" of thigh
• Fascia Iliaca : Covering Iliacus and Psoas

Lateral Femoral Cutaneous Nerve Sonography

Interface Identification

LFCN is visualized between 2 hyperechoic fascial layers

- *Fascia Lata : Superficial "sheath" of thigh*
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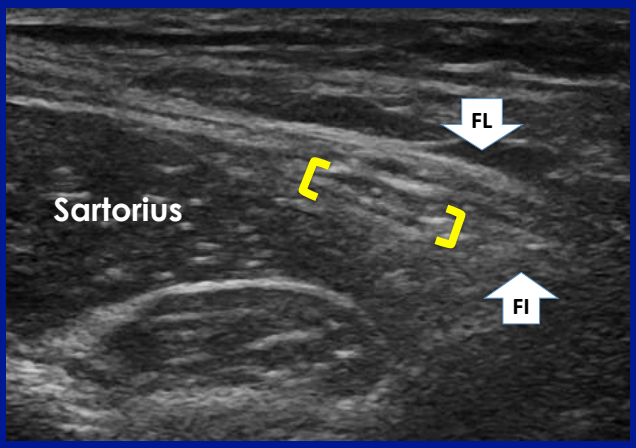
Lateral Femoral Cutaneous Nerve Sonography

Supine patient
SAX oblique probe at the ASIS parallel w Inguinal ligament
Translate probe distal (viz fascia NOT ligament !)

Ellipsoidal LFCN between hyperechoic FL and FI

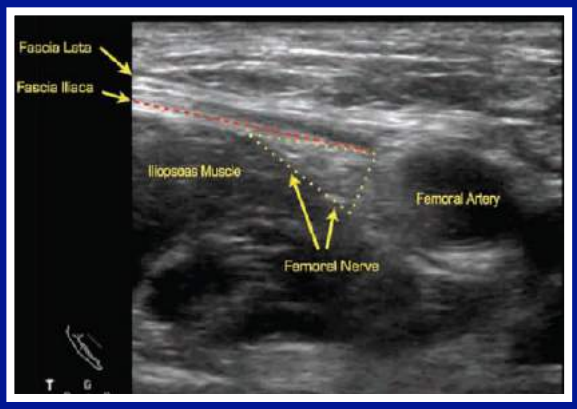
Lateral Femoral Cutaneous Nerve Sonography



The lateral femoral cutaneous nerve lying between the connective tissues of the fascia lata and fascia iliaca Medial to the sartorius muscle.

Ng I et al. Anesth Analg 2008;107:1070-1074

Lateral Femoral Cutaneous Nerve Sonography



The LCFN can be traced medial to lateral by identifying the femoral neurovascular bundle

Thank You !!!