

Rapid Ultrasound for Muscle Hemorrhage in Children with Hemophilia

Anjum Bandarkar, MD, Tara Cielma, Danyelle Holly, Adebunmi Adeyiga, MD
Children's National Health System, Washington D.C.

Disclosures

None

Objectives:

1. To describe utility of **rapid ultrasound** in detecting **muscle hemorrhage** in children with hemophilia
2. To illustrate **sonographic appearances** of muscle hemorrhage in various locations in the body

Background:

- Hemophilia is an **X-linked recessive** bleeding disorder due to deficiency of clotting factors, and occurs almost exclusively in males.
- Two subtypes:
 - Hemophilia A** (80 %) & **Hemophilia B** (20 %)
 - Factor VIII deficiency - Factor IX deficiency
 - *F8* gene mutation - *F9* gene mutation

Muscle hemorrhage is the **2nd most common complication** in hemophilia (after hemarthrosis)

Clinical Presentation:

- Child may present with focal swelling, pain, or refusal to use the affected body part
- Bleeding may be due to minor trauma or spontaneous
- Up to 23% of bleeding episodes occur in the muscles
- **Complications of muscle hemorrhage** include stiffness, decreased flexibility, muscle atrophy and limb loss
- Untreated hemorrhage into large muscle groups can cause **tissue compartment syndrome**, nerve compression, myositis ossificans, pseudotumor, infection & potential tissue death

Sonographic technique:

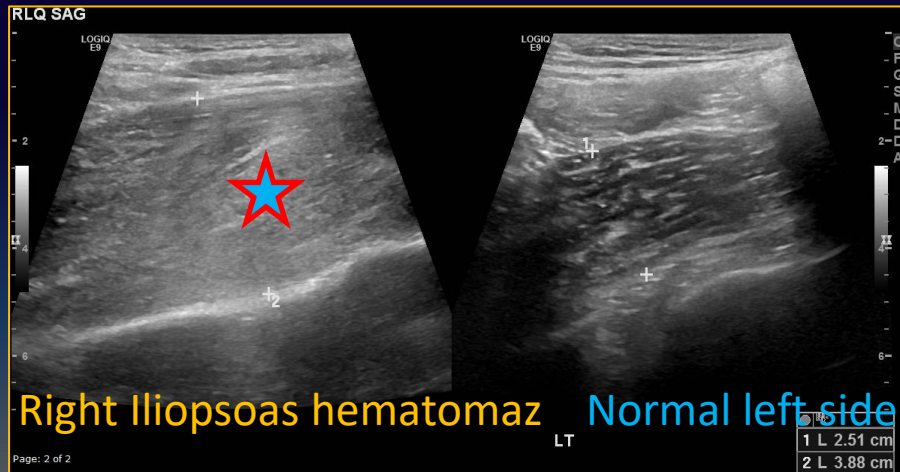
- Use high frequency linear transducer, prefer 9 to 15 MHz
- Use MSK setting with tissue harmonics
- Panoramic imaging is helpful for establishing landmarks
- Always compare with contralateral side

Common sites of muscle hemorrhage:

- Iliopsoas
- Quadriceps
- Gluteus
- Gastrocnemius
- Triceps
- Biceps
- Sternocleidomastoid
- Anterior abdominal wall

Sonographic Appearance of Muscle Hematoma:

- Asymmetric enlargement of muscle belly compared to contralateral side
- Architectural distortion of muscle fibers
- In acute phase, heterogeneously increased echogenicity★
- In late phase, it appears more hypoechoic



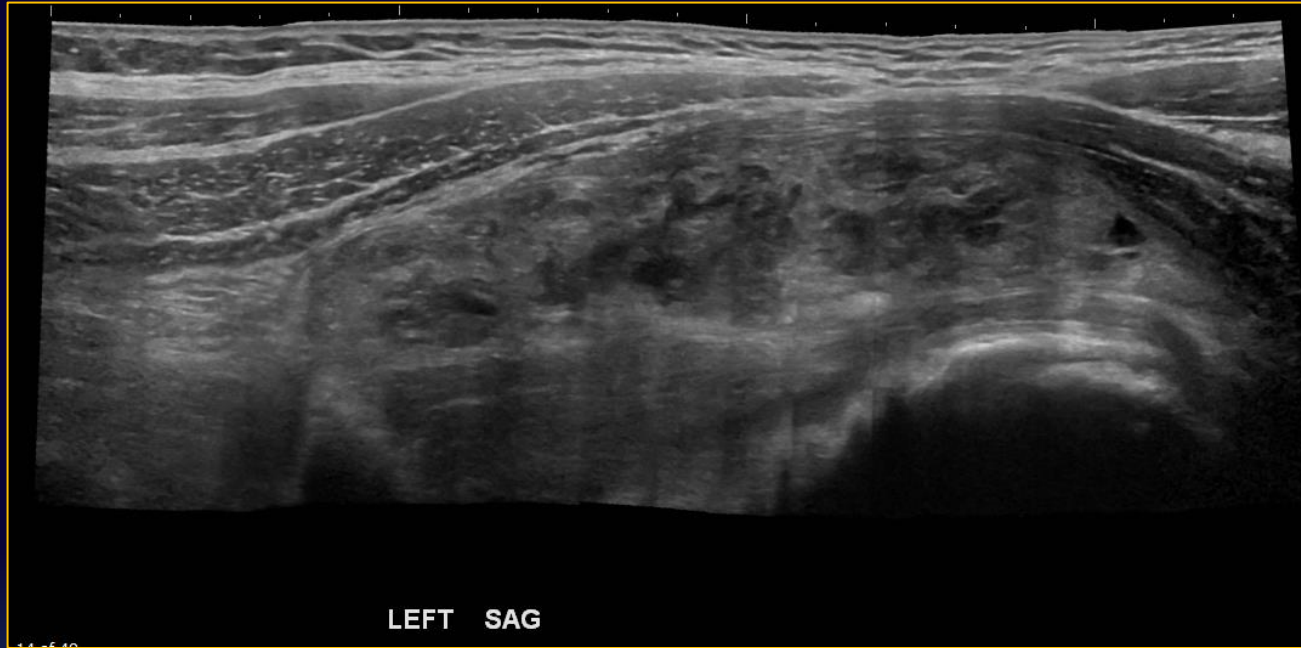
Right Iliopsoas hematoma

Normal left side



Panorama of right Iliopsoas hemorrhage

Iliopsoas Hematoma



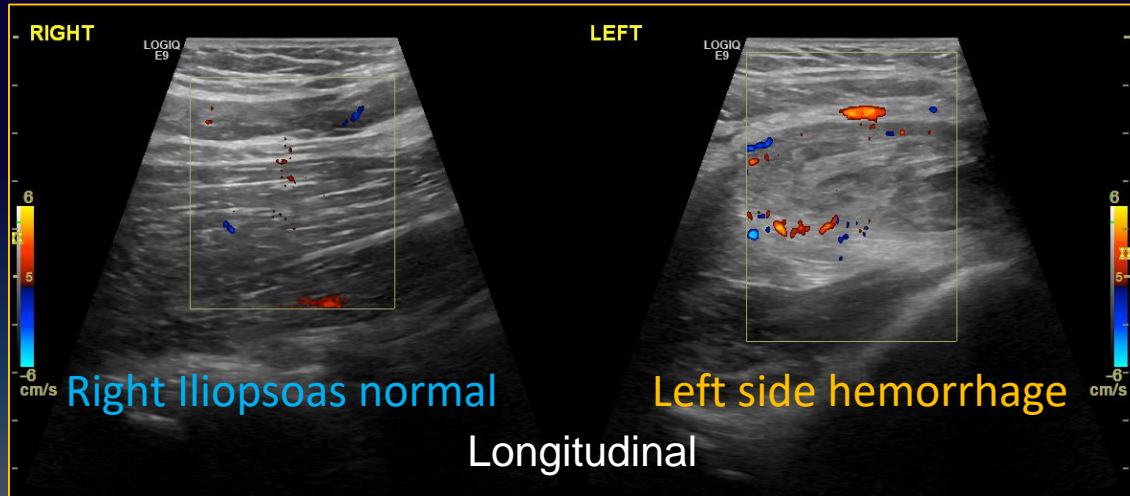
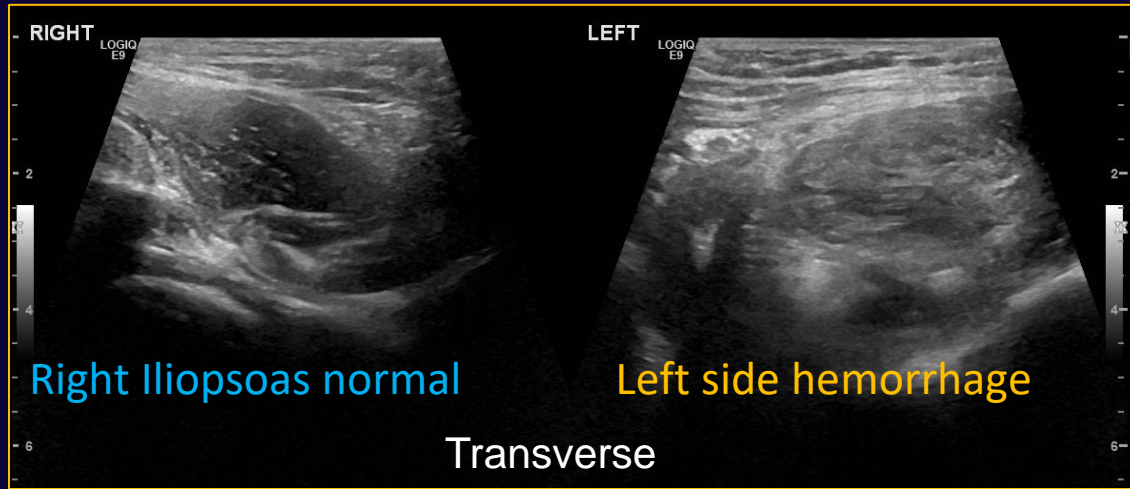
Case 1: A 14 year-old boy with Hemophilia A, s/p fall and left hip pain. Panoramic grayscale sagittal image shows heterogeneously echogenic and **enlarged left iliopsoas** muscle suggesting hemorrhage within the muscle belly. The hematoma measured 12 x 4.3 x 3.2 cm in size.

Iliopsoas Hematoma

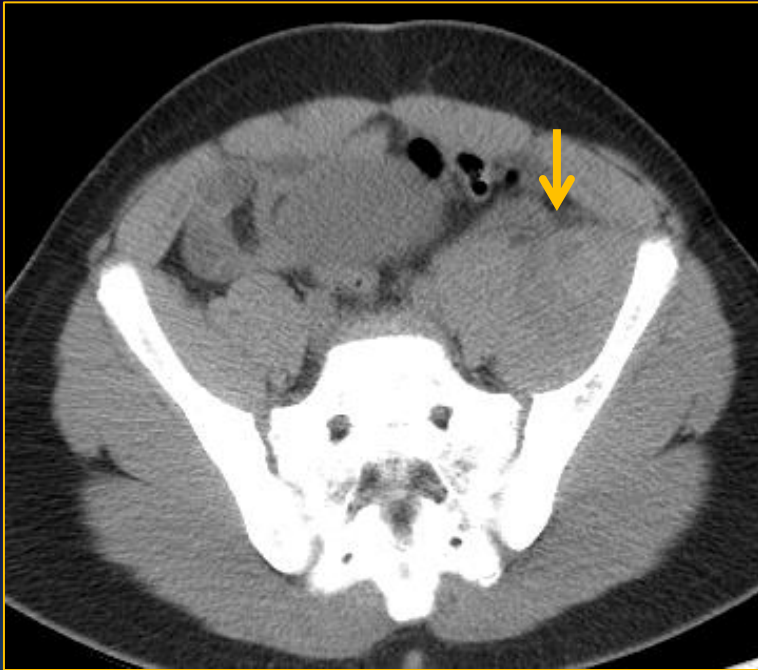
Case 1: A 14 year-old boy with Hemophilia A, s/p fall & pain

Grayscale transverse image shows asymmetric enlargement of left iliopsoas muscle compared to the normal right side, with internal heterogeneity and increased echogenicity suggesting hemorrhage.

Longitudinal color Doppler image shows lack of flow in the hematoma.



Iliopsoas Hematoma

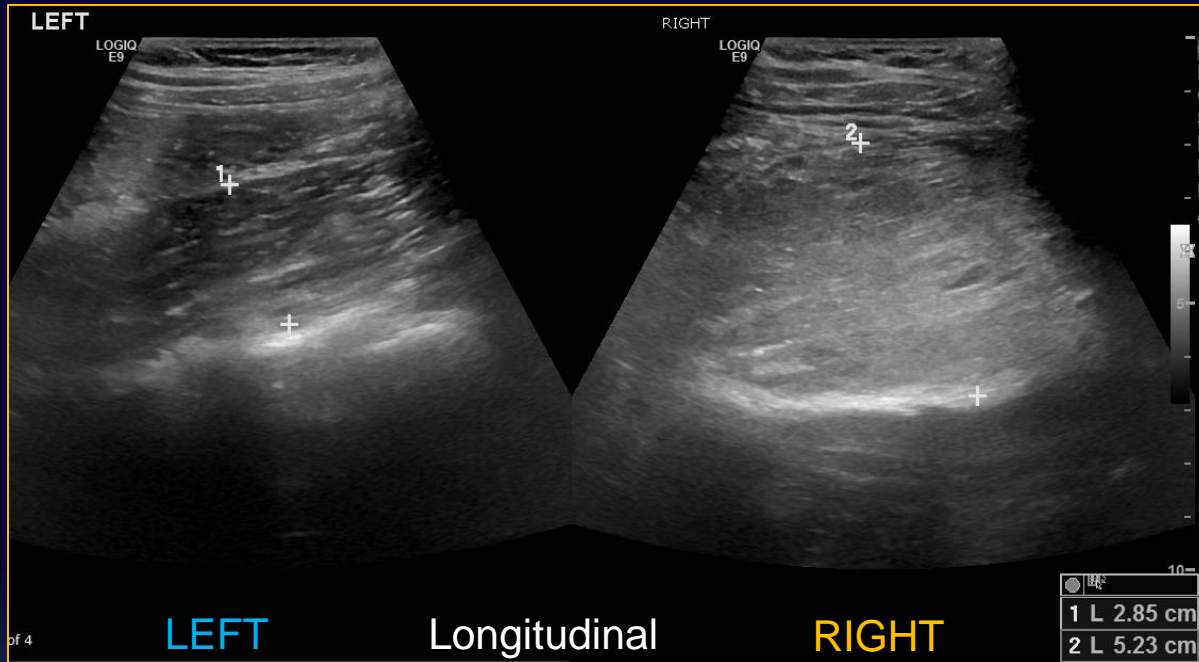


Case 1:

A 14 year-old boy with Hemophilia A, s/p fall and left hip pain.

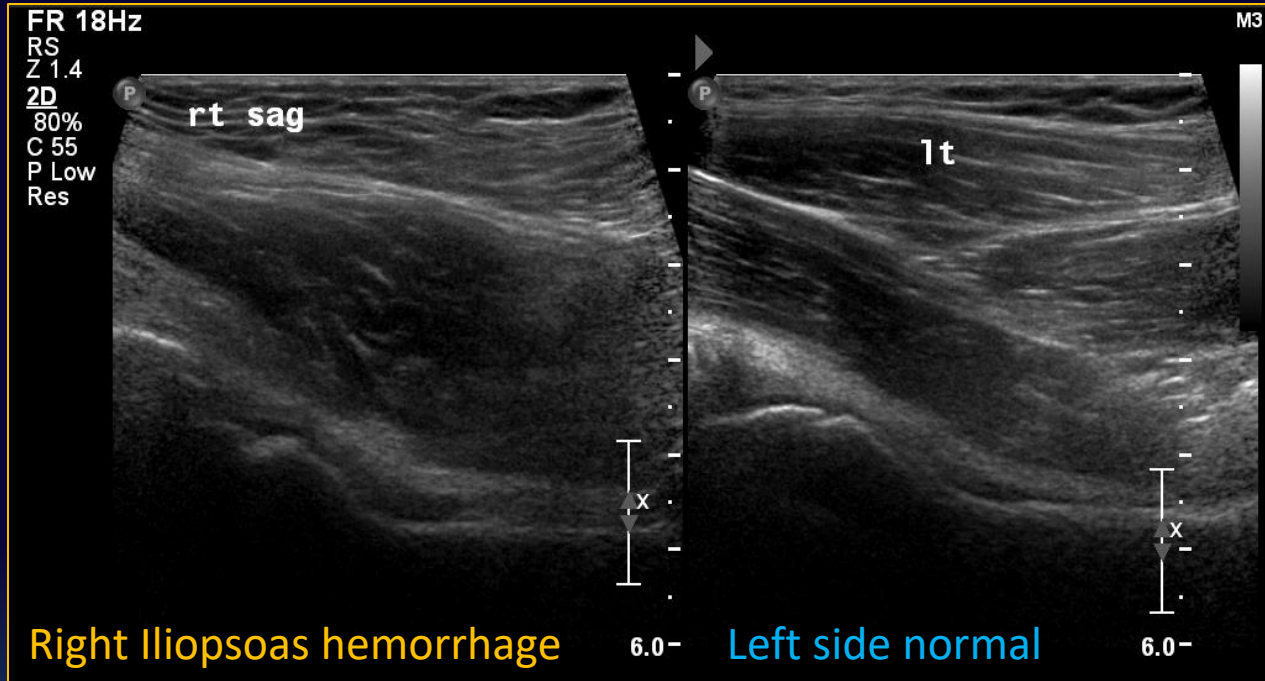
Noncontrast CT scan of the pelvis shows asymmetric enlargement of **left iliopsoas muscle** compared to the normal right side, with internal heterogeneity and surrounding fat stranding suggesting hemorrhage.

Iliopsoas Hematoma



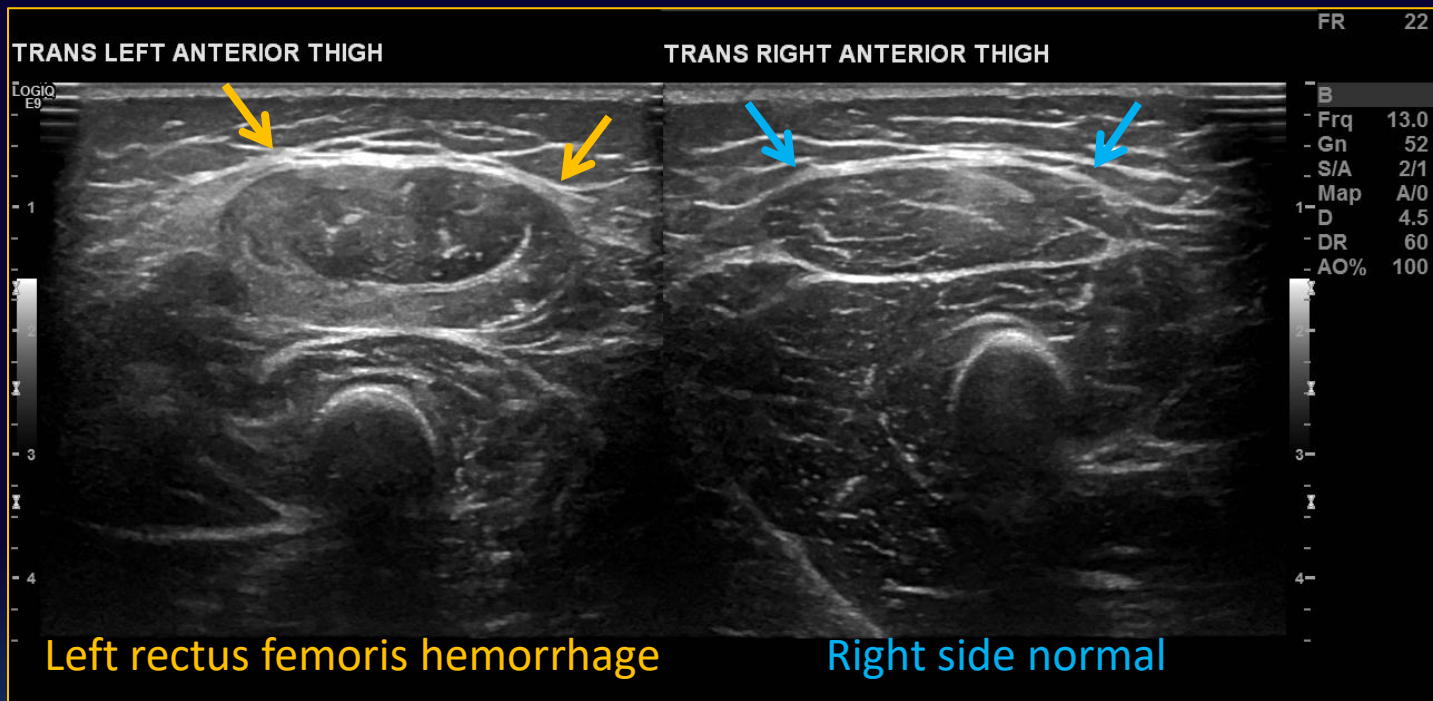
Case 2: A 10 year-old boy with Hemophilia A, presents with right hip pain
Grayscale longitudinal image shows asymmetric enlargement of **right** iliopsoas muscle compared to the **normal left side**, with intramuscular architectural distortion and increased echogenicity suggesting hemorrhage.

Iliopsoas Hematoma



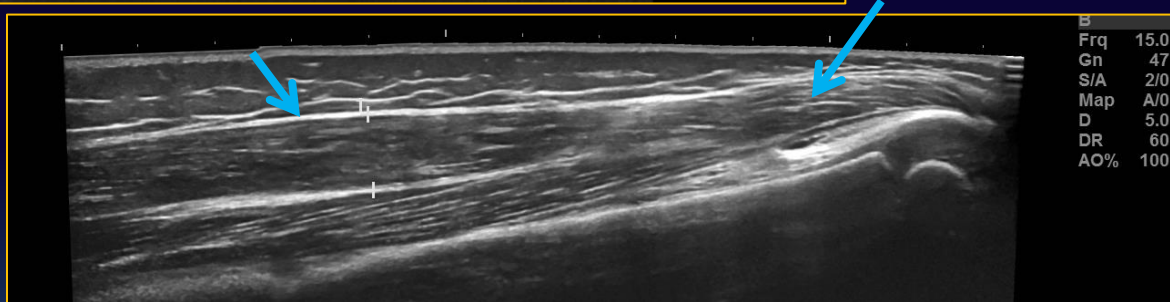
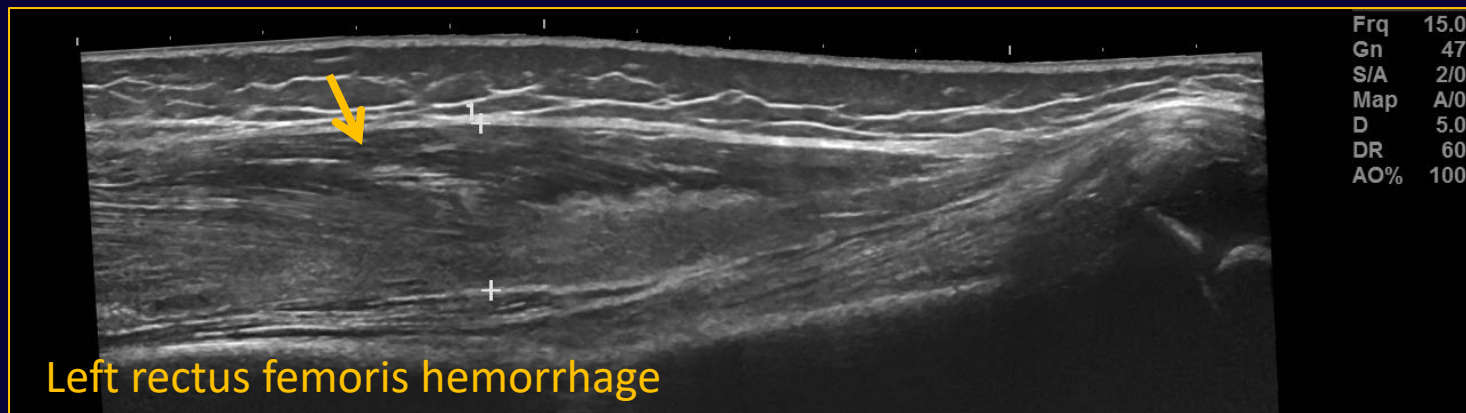
Case 3: A 12 year-old boy with Hemophilia B, presents with right hip pain
Grayscale longitudinal image shows asymmetric enlargement of **right** iliopsoas muscle compared to the normal left side, suggesting muscle hemorrhage.

Quadriceps Hematoma



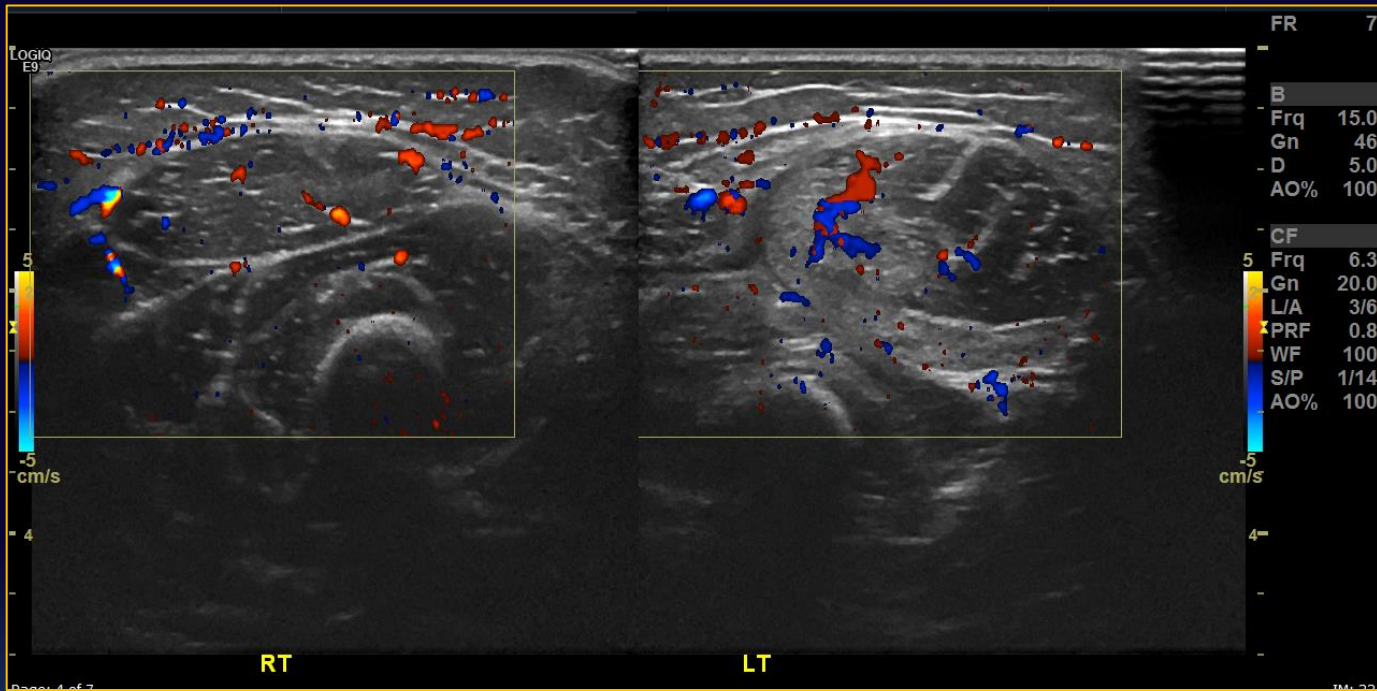
Case 4: A 3 year-old boy with Hemophilia A, presents with left thigh pain. Grayscale transverse image shows asymmetric enlargement & increased echogenicity of left rectus femoris muscle compared to the normal right side, c/w muscle hematoma.

Quadriceps Hematoma



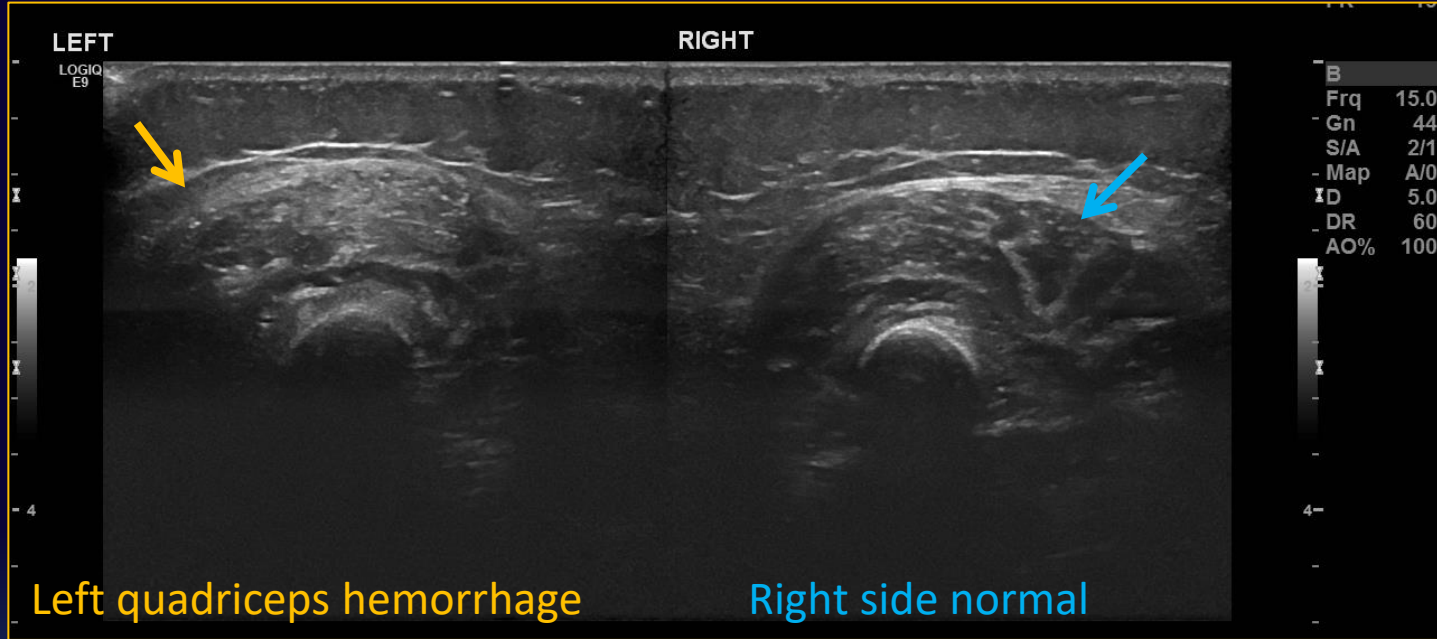
Case 4: A 3 year-old boy with Hemophilia A, presents with left thigh pain. Panoramic grayscale longitudinal image shows **left rectus femoris muscle hemorrhage** and normal appearance of right side.

Quadriceps Hematoma



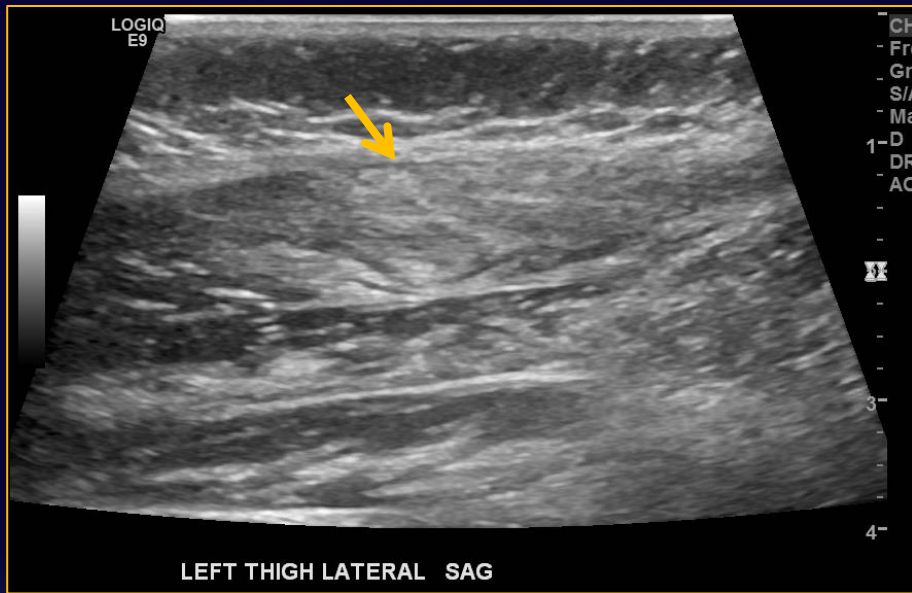
Case 4: A 3 year-old boy with Hemophilia A, presents with left thigh pain. Color Doppler transverse side-by-side image again shows the **left rectus femoris muscle hematoma** compared to the **normal right side**.

Quadriceps Hematoma

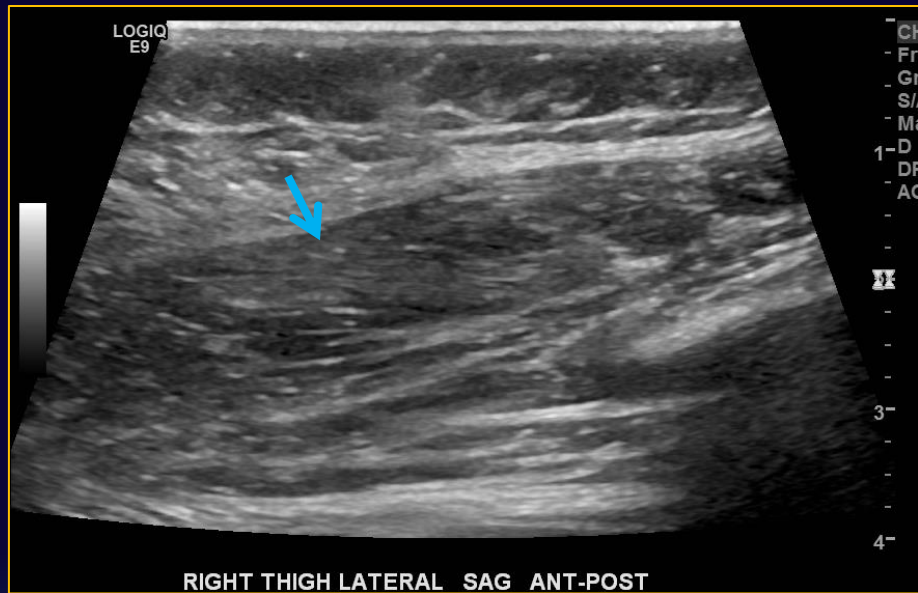


Case 5: A 4 month-old boy with Hemophilia A, & left thigh swelling post immunization. Grayscale transverse image shows increased echogenicity of **left quadriceps muscle** compared to the **normal right side**, suggesting muscle hemorrhage.

Quadriceps Hematoma



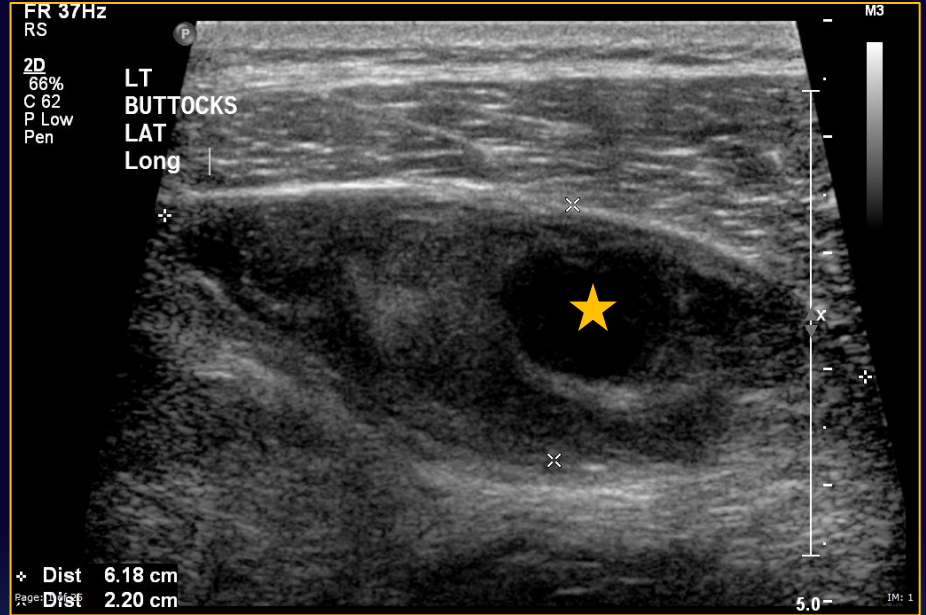
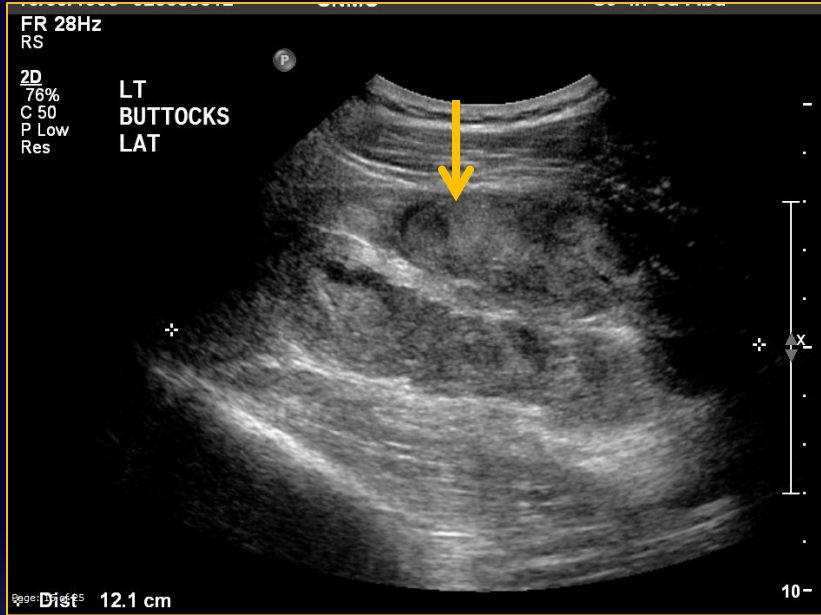
Left quadriceps hemorrhage



Right side normal

Case 5: A 4 month-old boy with Hemophilia A, & left thigh swelling post immunization. Grayscale longitudinal image shows increased echogenicity of **left quadriceps muscle** compared to the **normal right side**, suggesting muscle hemorrhage.

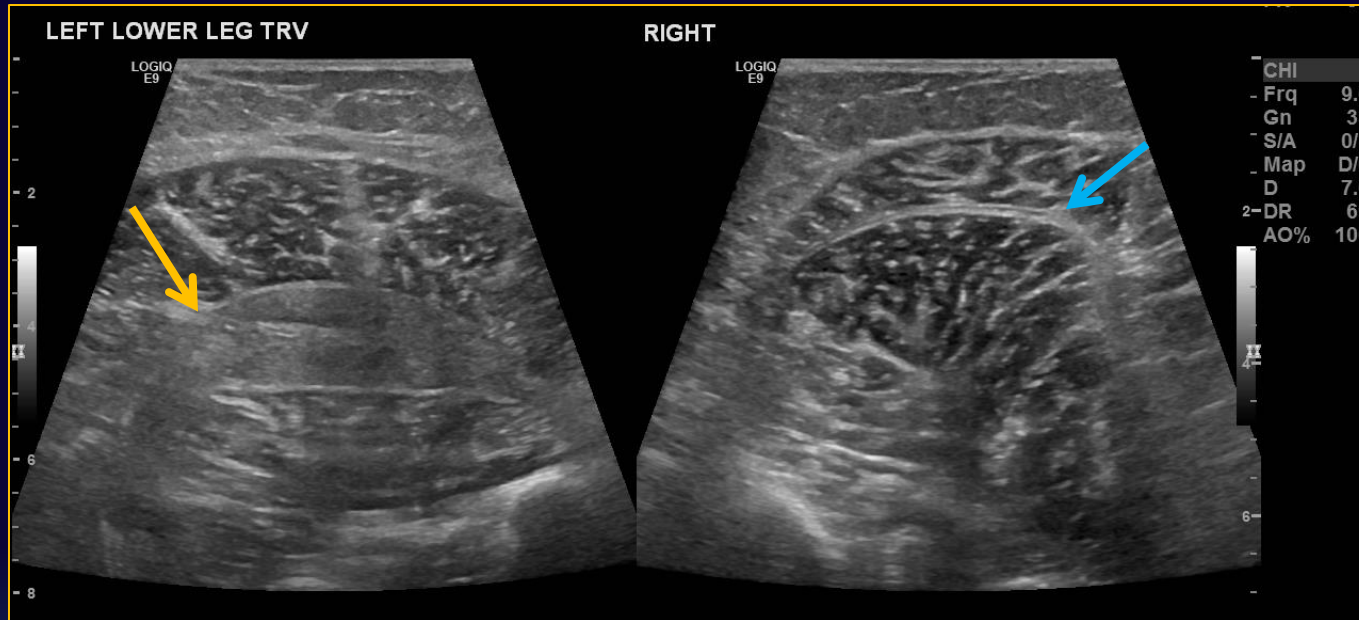
Gluteus muscle Hematoma



Left gluteus muscle hemorrhage

Case 6: A 15 year-old boy with Hemophilia A, & left buttock swelling post trauma. Grayscale transverse image shows heterogeneously increased echogenicity of **left gluteus muscle** with areas of liquefied hematoma★, suggesting muscle hemorrhage.

Gastrocnemius Hematoma

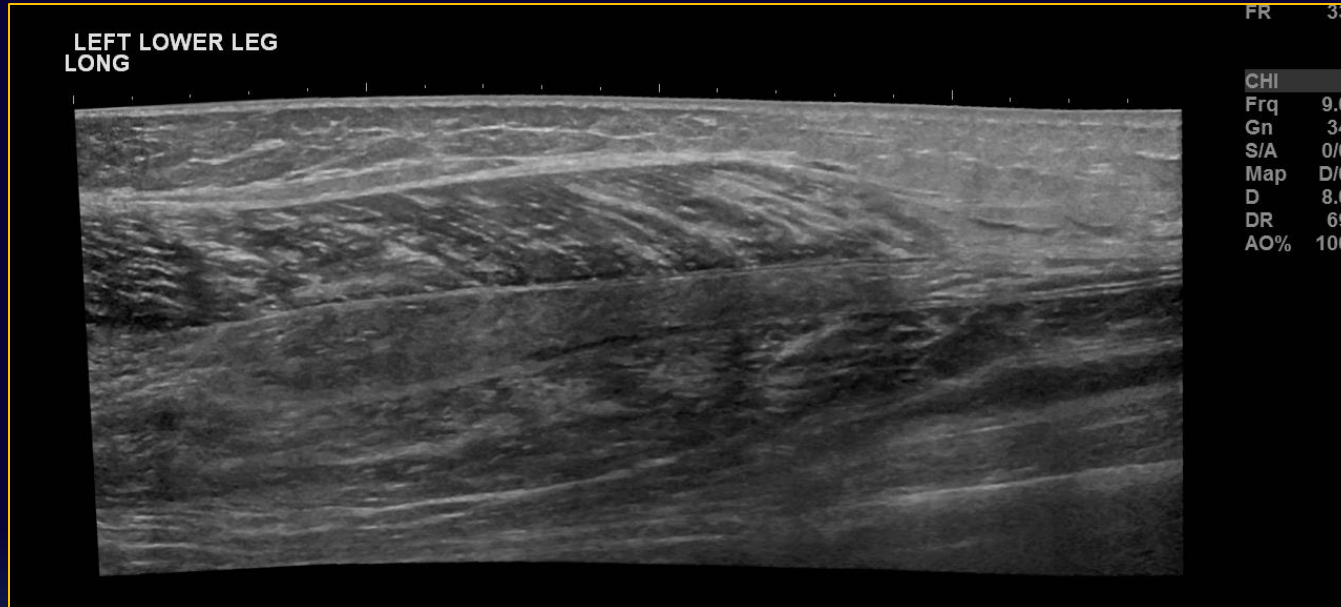


Left gastrocnemius hemorrhage

Right side normal

Case 7: An 11 year-old boy with Hemophilia A, presents with left calf pain. Grayscale transverse image shows asymmetric enlargement & increased echogenicity of **left gastrocnemius** compared to the **normal right side**, suggesting muscle hematoma.

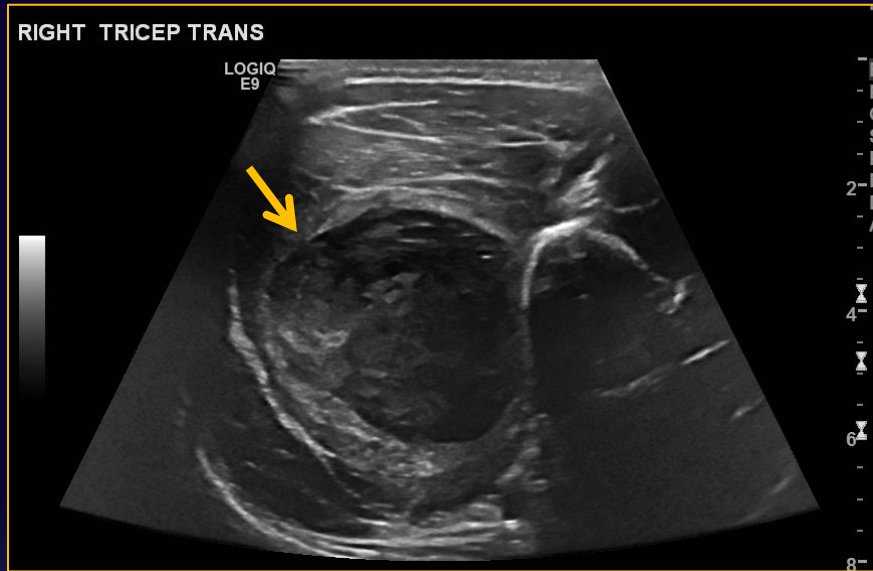
Gastrocnemius Hematoma



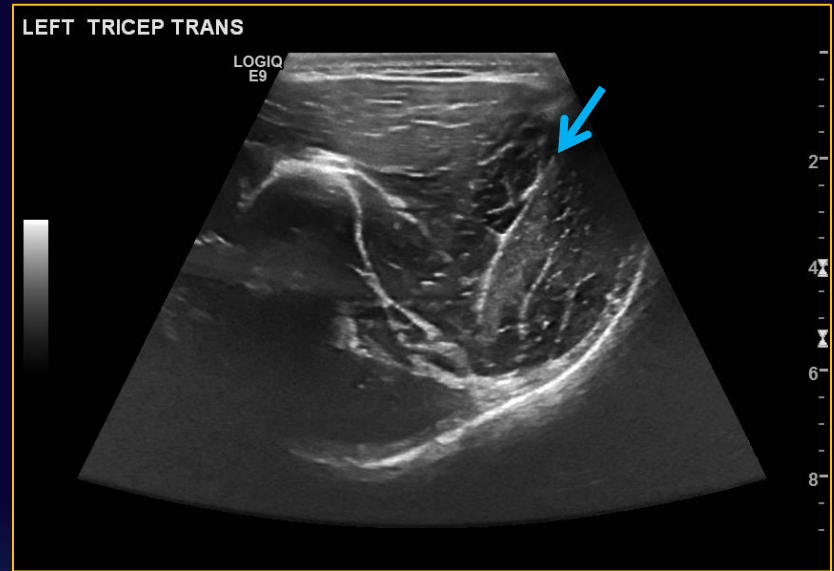
Left gastrocnemius hemorrhage

Case 7: An 11 year-old boy with Hemophilia A, presents with left calf pain. Panoramic grayscale longitudinal image shows enlargement & increased echogenicity of **left gastrocnemius** muscle, suggesting muscle hematoma.

Triceps muscle Hematoma



Right triceps muscle hematoma

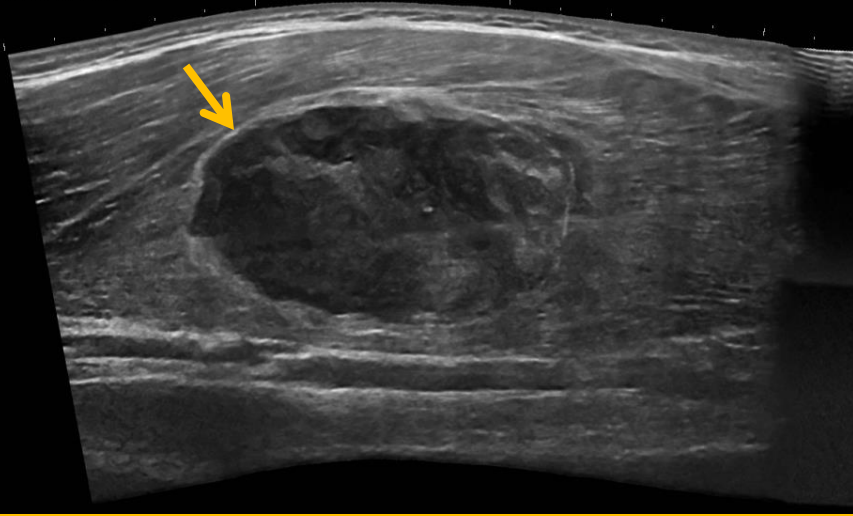


Left side normal

Case 8: A 16 year-old boy with Hemophilia A, presents with right arm swelling. Grayscale transverse image shows enlargement right triceps muscle compared to the normal left side, with hypoechoic hematoma within the right triceps muscle belly.

Triceps muscle Hematoma

RIGHT TRICEP SAG



Right triceps muscle hematoma

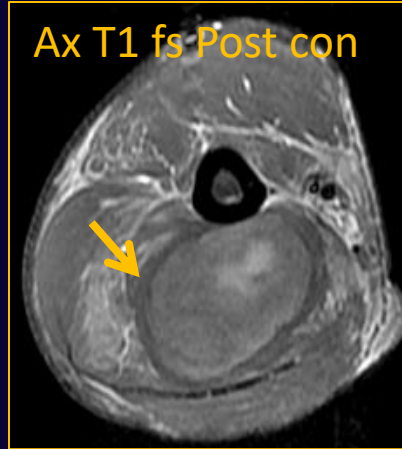
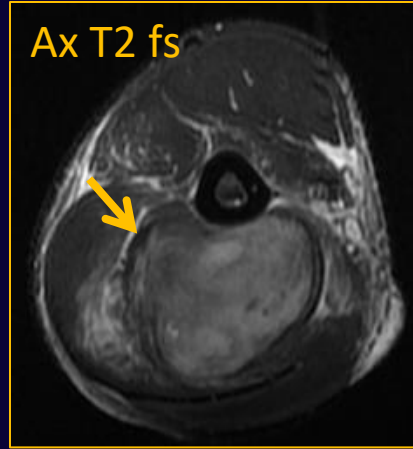
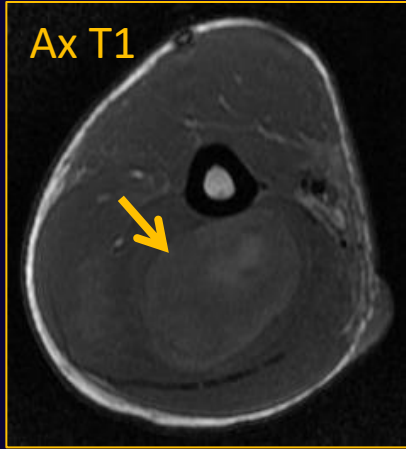
LEFT TRICEP SAG



Left side normal

Case 8: A 16 year-old boy with Hemophilia A, presents with right arm swelling. Panoramic grayscale longitudinal image shows large **right triceps muscle hematoma** compared to the **normal left side**, the hematoma measured 8 x 5 x 4 cm size.

Triceps muscle Hematoma

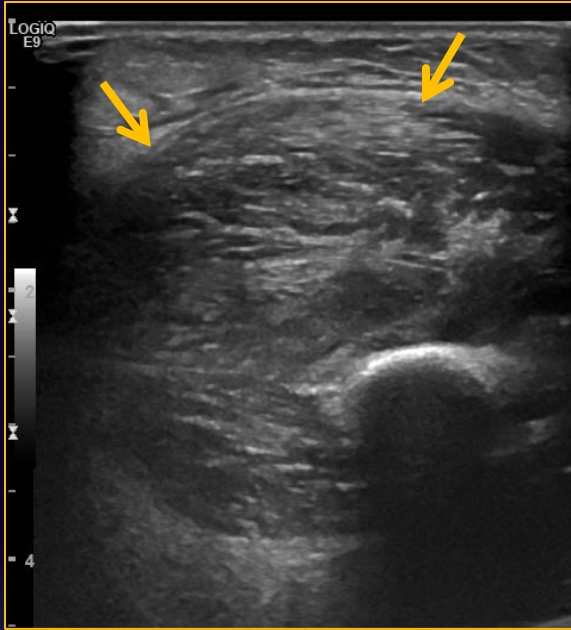


Case 8: A 16 year-old boy with Hemophilia A, presents with right arm swelling s/p football injury.

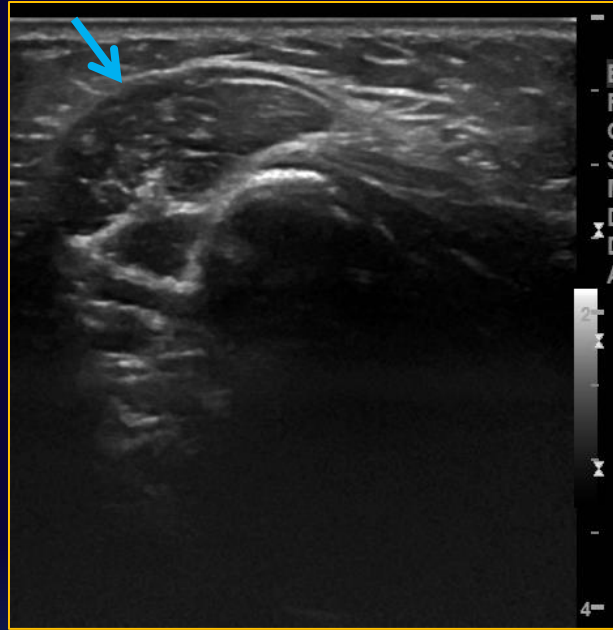
Ax T1 image of right mid arm shows hyperintense **right triceps intramuscular hematoma**.

Ax & Sag T2 images show peripheral rim of hypointensity.
Post contrast Ax T1 – no enhancement in hematoma.

Upper extremity – Biceps Hematoma



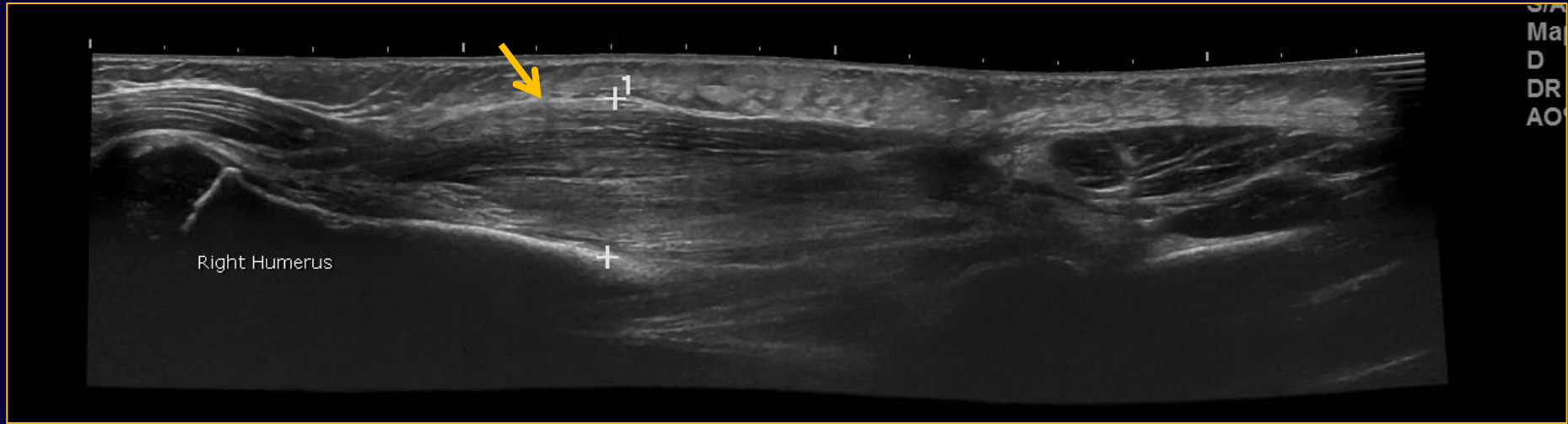
Right biceps hemorrhage



Left arm normal

Case 9: A 8 month-old boy with Hemophilia A, & right arm swelling post immunization. Grayscale transverse image shows increased echogenicity of **right biceps muscle** compared to the **normal left side**, suggesting muscle hemorrhage.

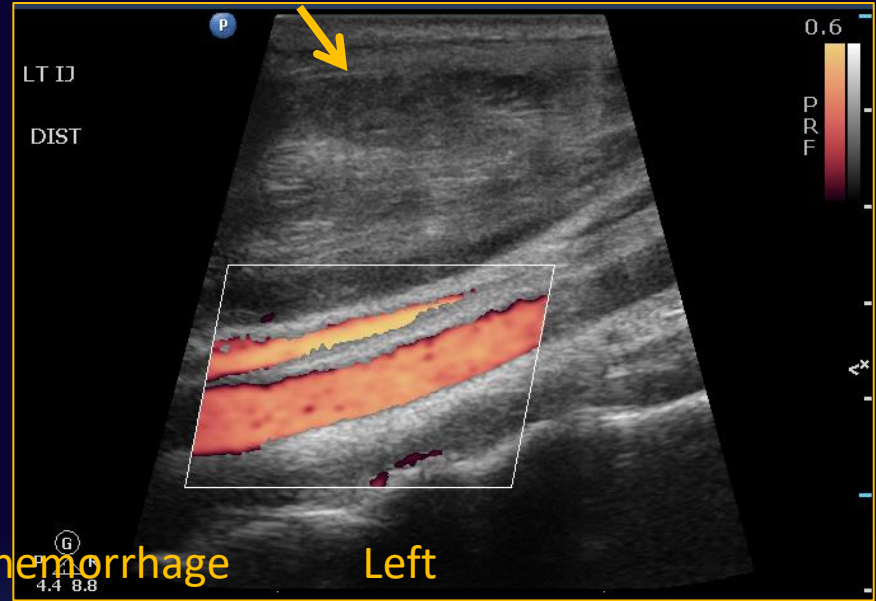
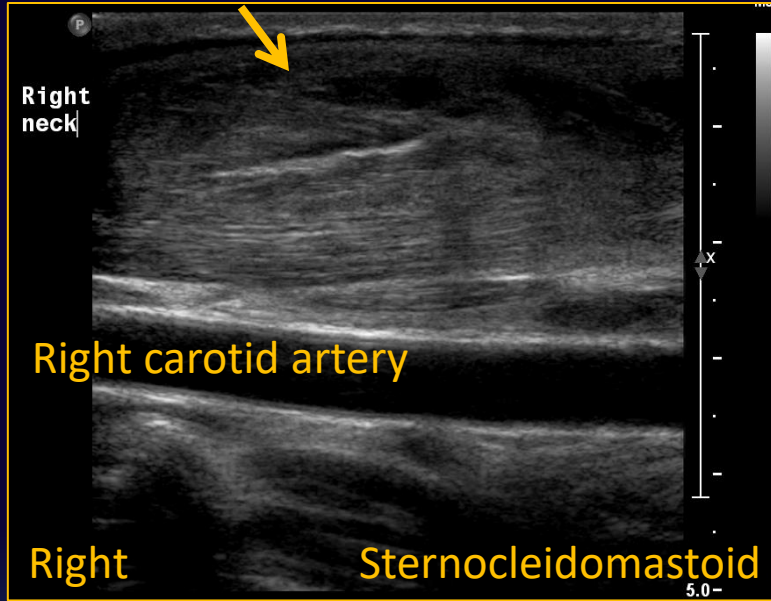
Upper extremity – Biceps Hematoma



Right biceps muscle hemorrhage

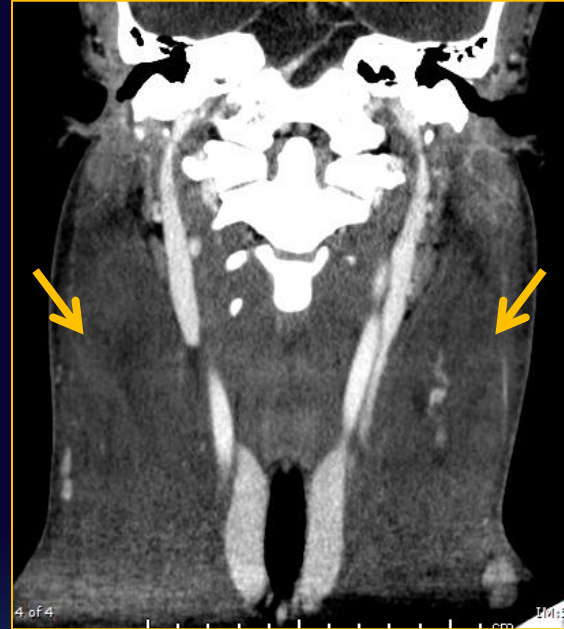
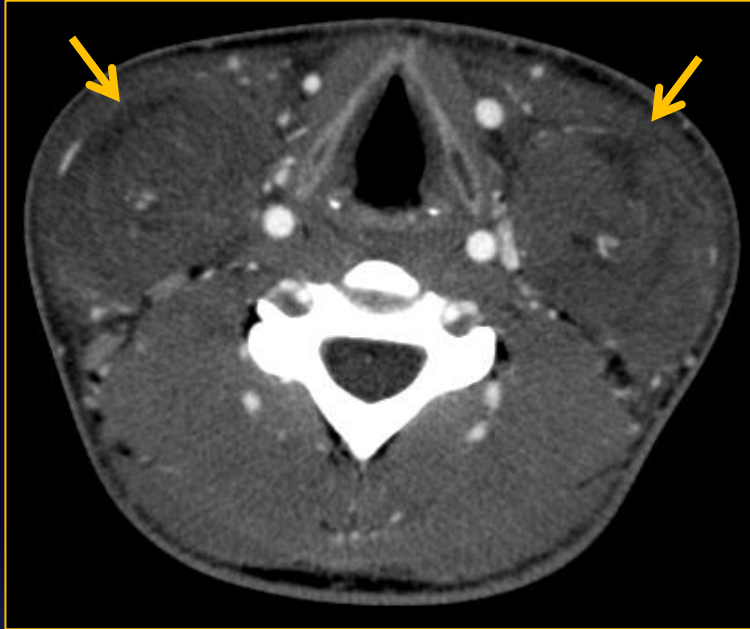
Case 9: A 8 month-old boy with Hemophilia A, & right arm swelling post immunization. Panoramic grayscale longitudinal image shows enlargement and increased echogenicity of **right biceps muscle**, suggesting muscle hemorrhage.

Sternocleidomastoid Hematoma



Case 10: A 21 year-old man with Hemophilia A, & bilateral neck swelling and pain. Grayscale and Doppler images show heterogeneous enlargement of **both sternocleidomastoid muscles**, suggesting muscle hemorrhage. Resultant compression of bilateral IJV noted.

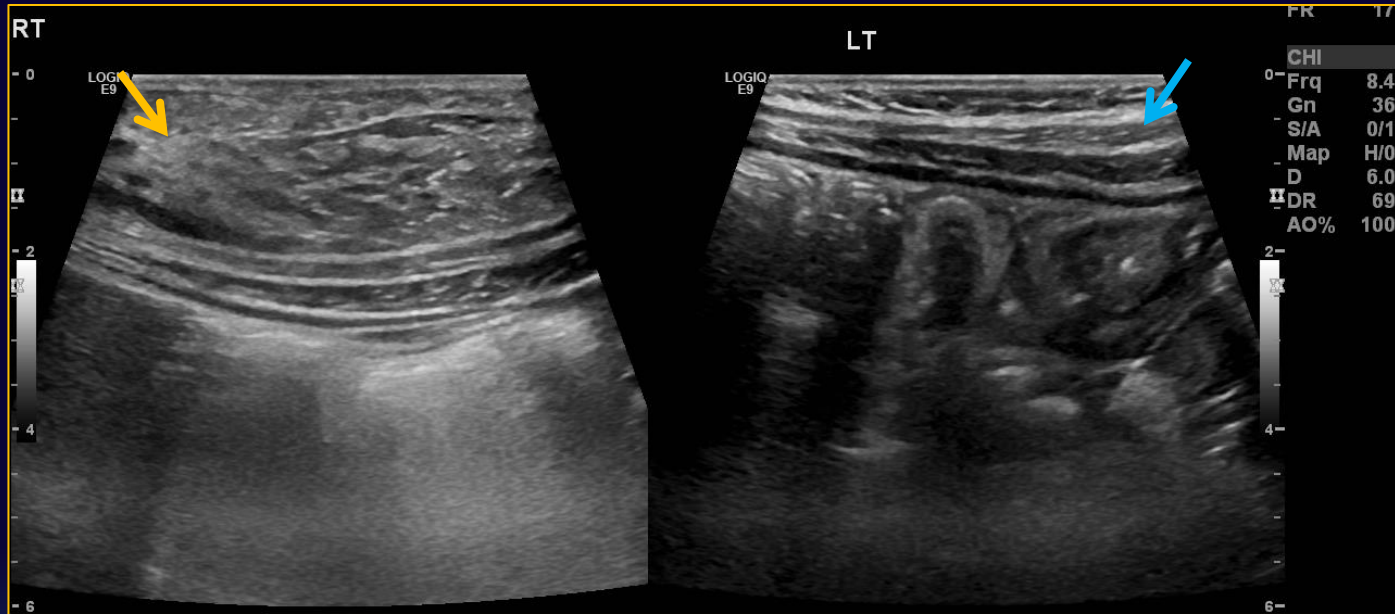
Sternocleidomastoid Hematoma



CTA: Bilateral sternocleidomastoid muscle hemorrhage

Case 10: A 21 year-old man with Hemophilia A, & bilateral neck swelling and pain. CT angiogram images show heterogeneous enlargement of **both sternocleidomastoid muscles**, suggesting muscle hemorrhage & mass effect on bilateral jugular veins.

Anterior abdominal wall Hematoma



Right anterior abdominal wall muscle hemorrhage

Left side normal

Case 11: A 2 year-old boy with Hemophilia A, presents with abdominal wall swelling. Grayscale oblique images show heterogeneously increased echogenicity and thickening of **right anterior abdominal wall muscle**, suggesting muscle hemorrhage.

Take home points:

- Bleeding episodes in the musculoskeletal system are a **common complication** in patients with **hemophilia**.
- **Common sites of muscle hemorrhage** include iliopsoas, quadriceps, gastrocnemius, gluteus, triceps, biceps, sternocleidomastoid and anterior abdominal wall muscles.
- Untreated hemorrhage into large muscle groups can cause **tissue compartment syndrome**, nerve compression, myositis ossificans, pseudotumor, infection & potential tissue death.

Take home points:

- **Timely diagnosis** of muscle bleed is essential for management.
- **Rapid ultrasound is a quick and effective** modality to diagnose muscle hemorrhage.
- **Use of high frequency transducers, tissue harmonics and panoramic imaging** greatly improves the diagnosis of muscle hemorrhage.
- Ultrasound can aid in detecting superadded infection and **provide guidance for aspiration** and drainage.

Take home points:

- Radiologists and clinicians **must familiarize themselves** with the sonographic appearance of muscle hemorrhage in various locations in the body.

Thank You

Author info: Anjum Bandarkar
anjumnb@gmail.com