

Deep Venous Thrombosis

Objectives

- DVT ultrasound
 - indications
 - anatomy
 - scanning techniques
 - normal sonographic findings
 - pathologic sonographic findings
 - pitfalls

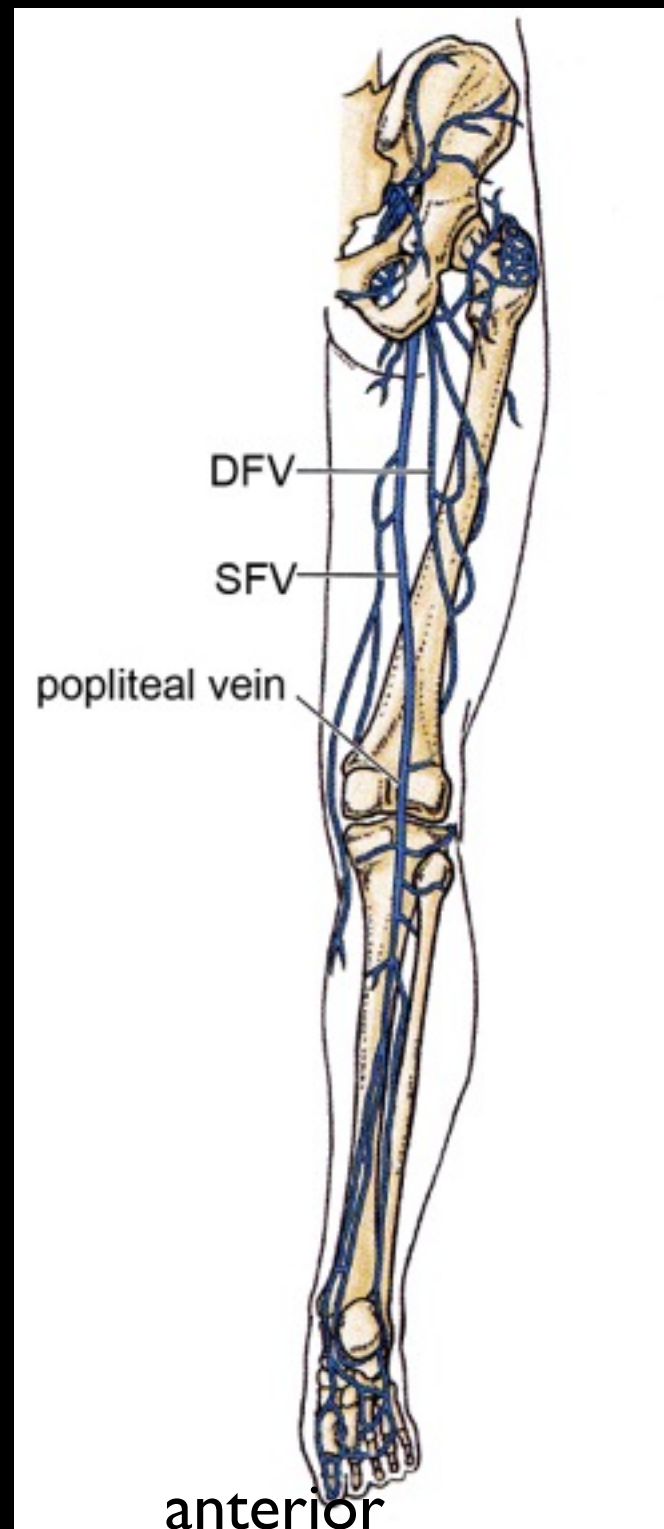
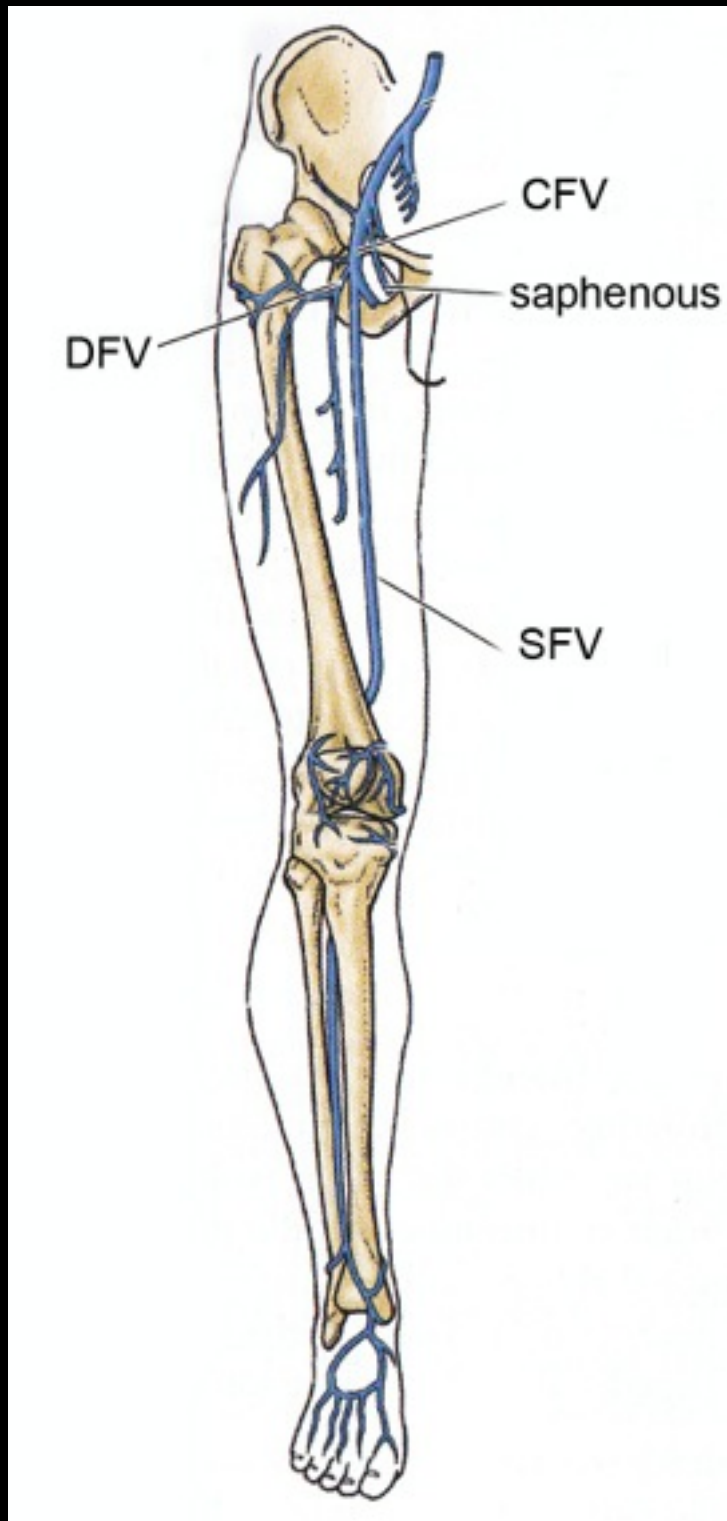
Indications

- Screening for patients with symptoms of DVT
- Physical exam unreliable
 - tenderness: 75%
 - swelling: 80%
 - palpable cords: rare

Pre-test Probability

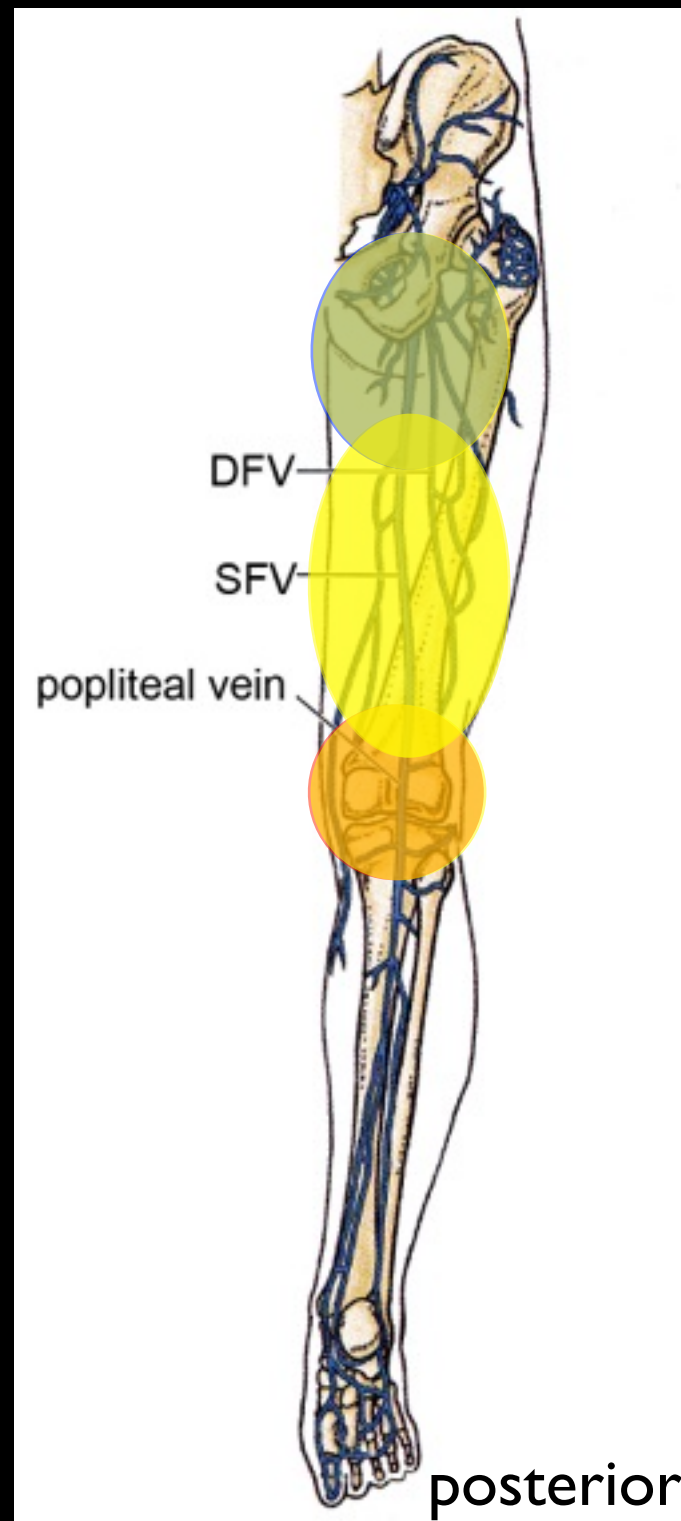
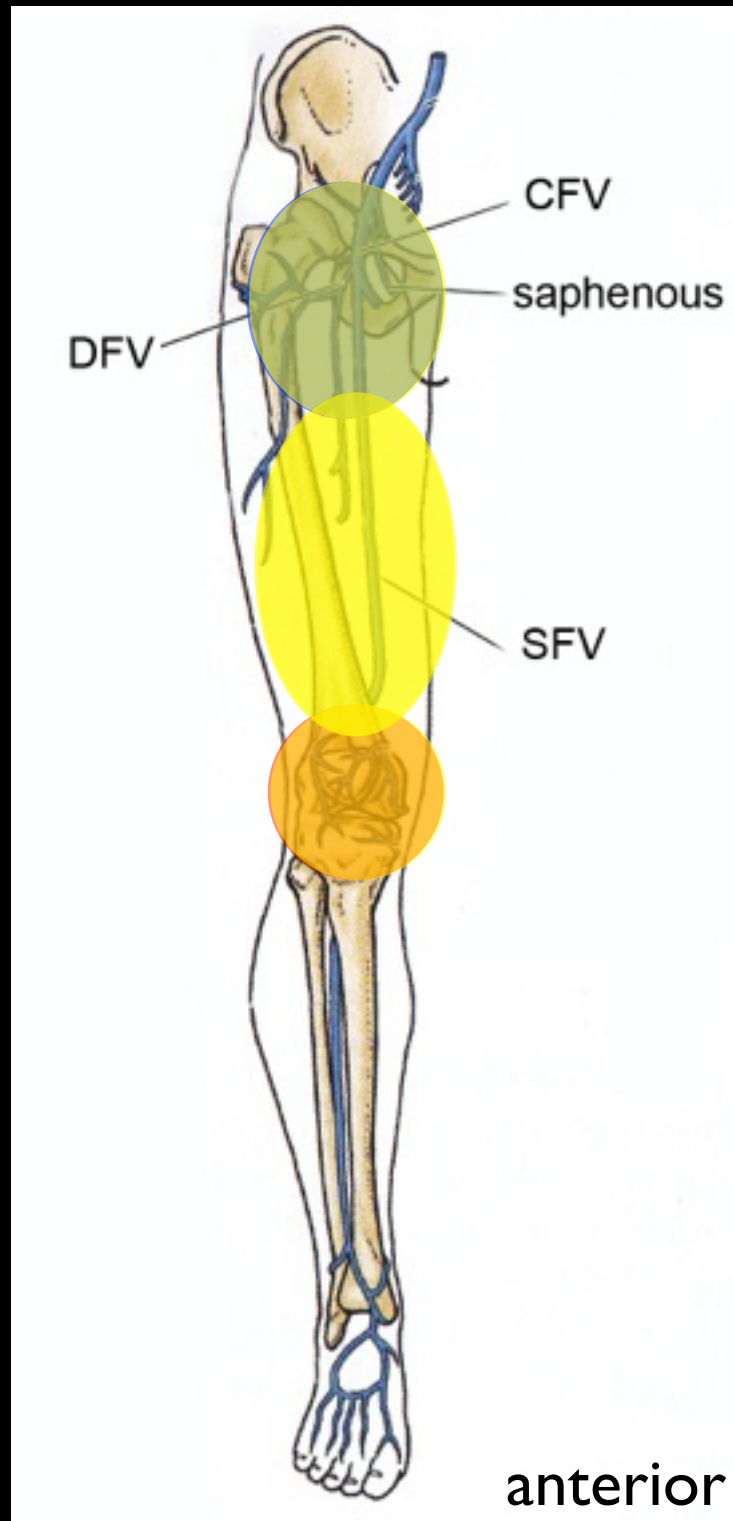
- Sensitivity for ultrasound approaches 85%
- DVT ultrasound techniques is an imperfect test
 - calf vein thrombosis
 - partially occluded vessels
 - poor visualization

Lower Extremities



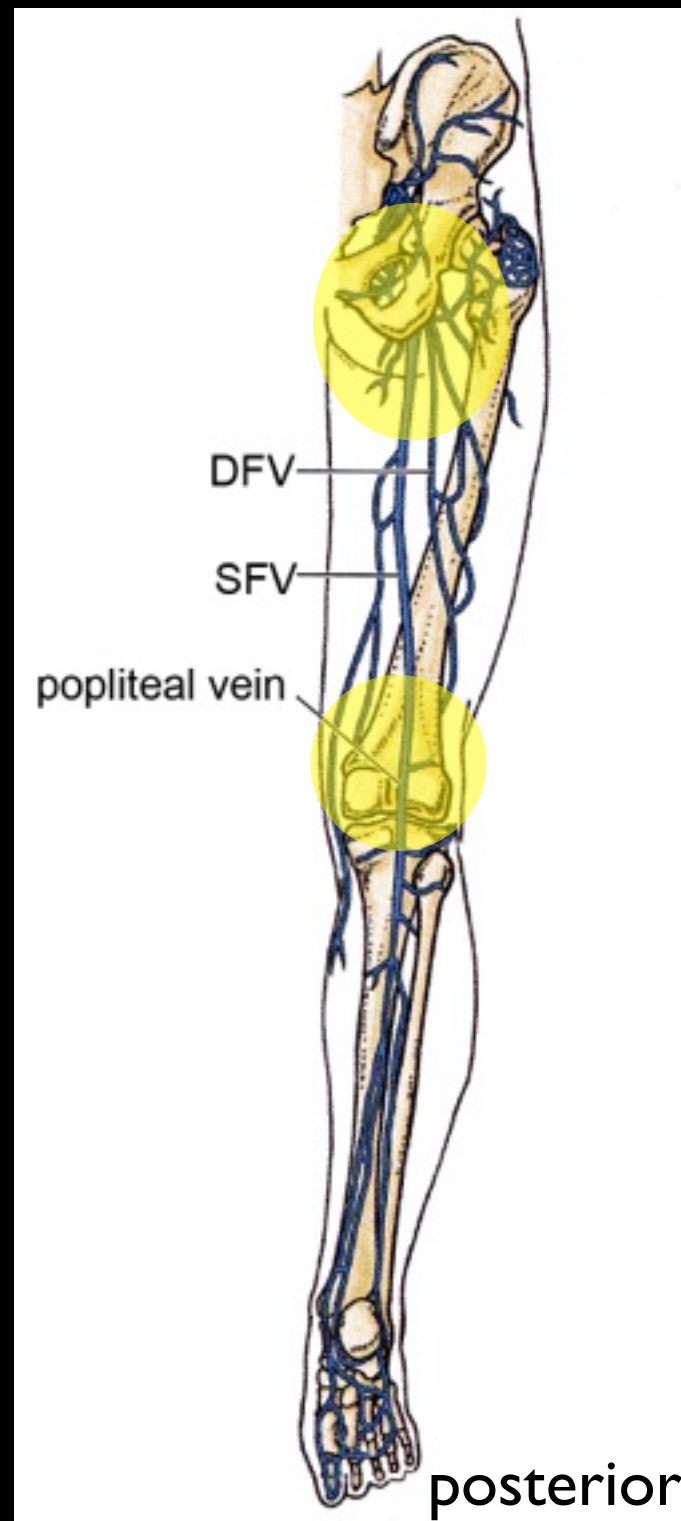
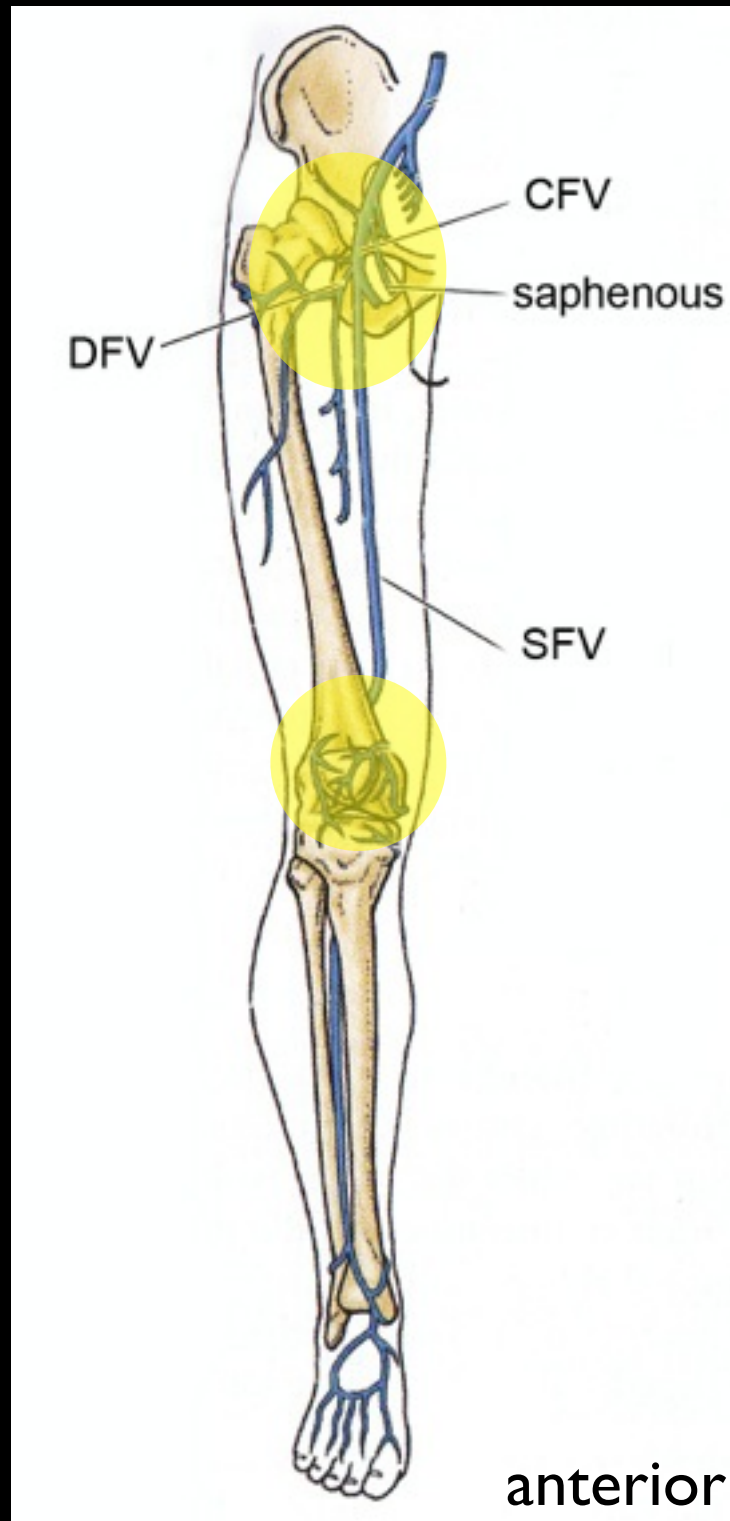
- Traditional technique
 - sequential compression from inguinal ligament to bifurcation of popliteal
 - time consuming and challenging

Lower Extremities



- DVT location
 - 10% within popliteal
 - 42% popliteal and SFV
 - 5% popliteal, SFC, CFV
 - 35% all proximal veins
 - 8% in CFV +/- IVC or iliacs

Lower Extremities



- DVT located in CFV or popliteal vein in almost every case
 - sensitivity 85-90%
- poor sensitivity for calf vein DVT
 - 25% propagate
 - usually in 1st week

Technical Considerations

2 Point Compression

- 2 Point Compression technique
 - CFV followed distally ~5cm
 - popliteal followed distally to bifurcation
- 160 positive US in symptomatic patients reviewed retrospectively
 - 91% (146 cases) had proximal vein thrombosis
 - 145 involved either CFV or popliteal
 - 1 involved isolated SFV
 - Time savings (18.0 min vs 8.3 min)

Technical Considerations

Probe Selection

- High frequency linear probe
- excellent resolution at shallow depths



Technical Considerations

Patient Positioning



- dependent body positioning

Technical Considerations

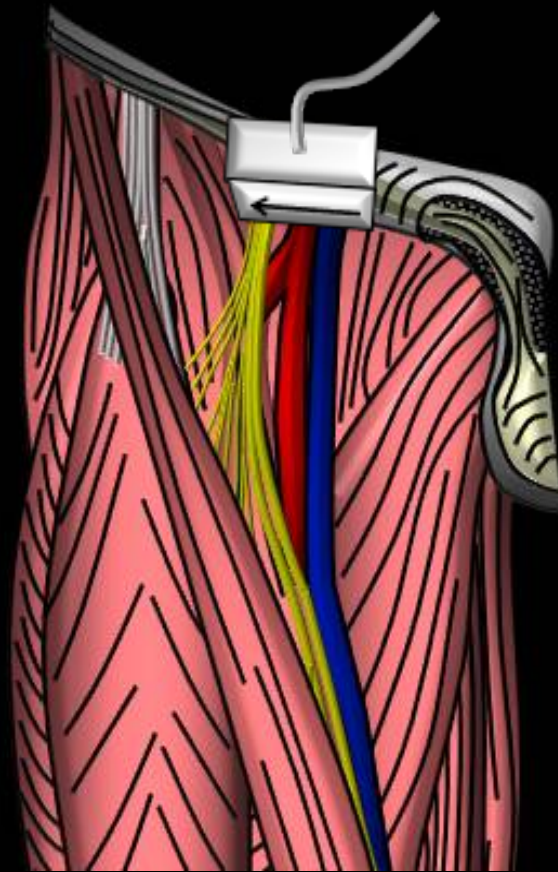
Patient Positioning

- frog-leg position
 - allows access to femoral and popliteal spaces



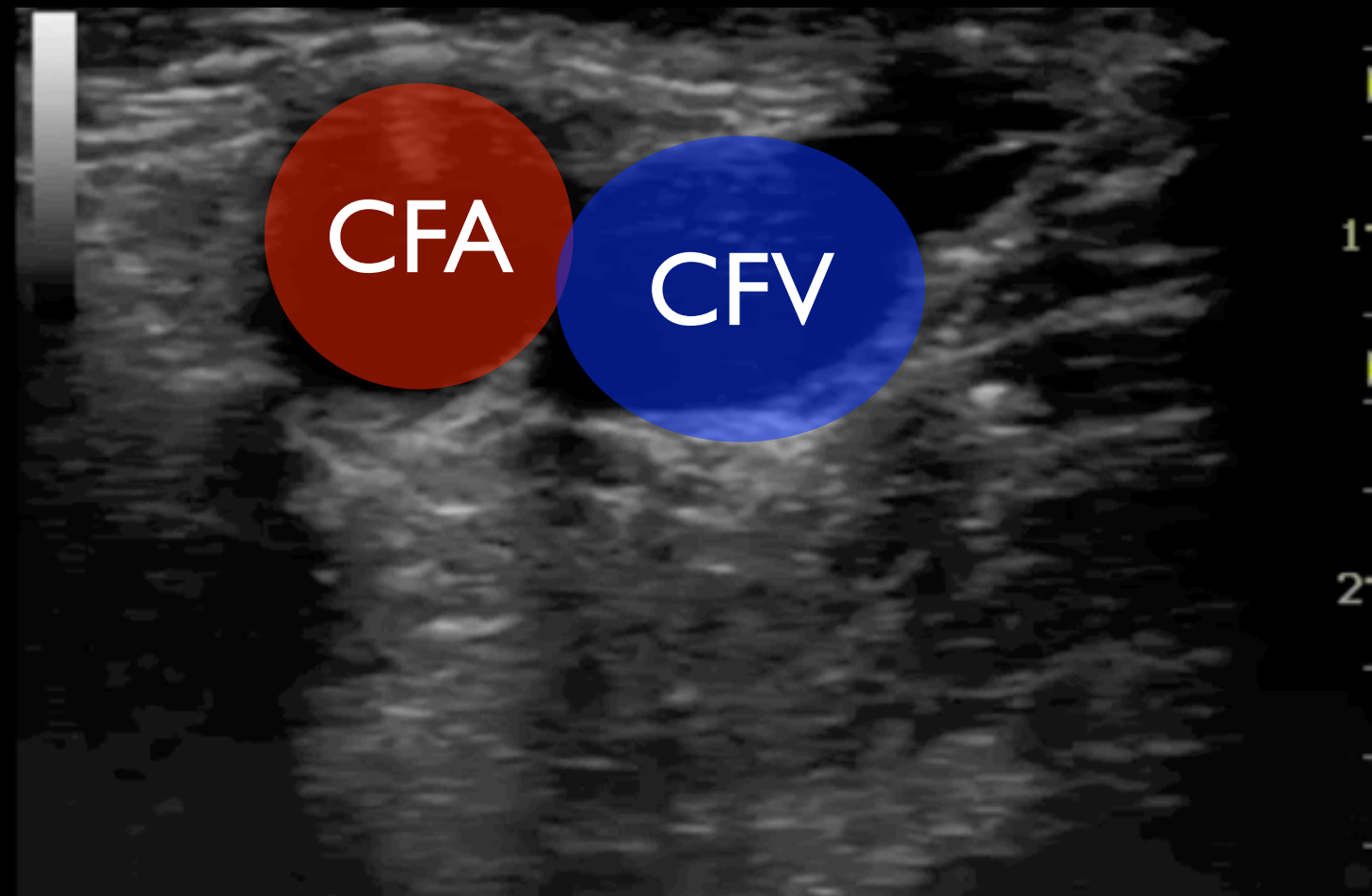
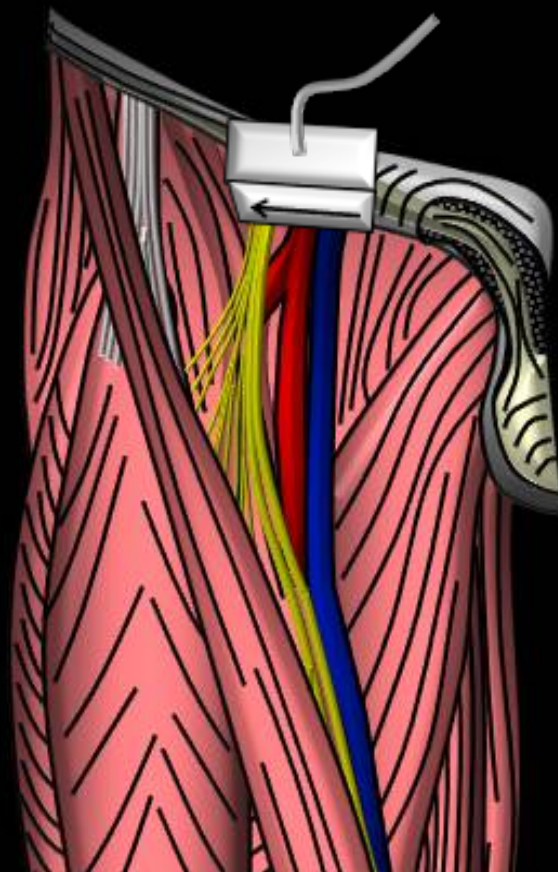
Normal Sonographic Findings

Femoral



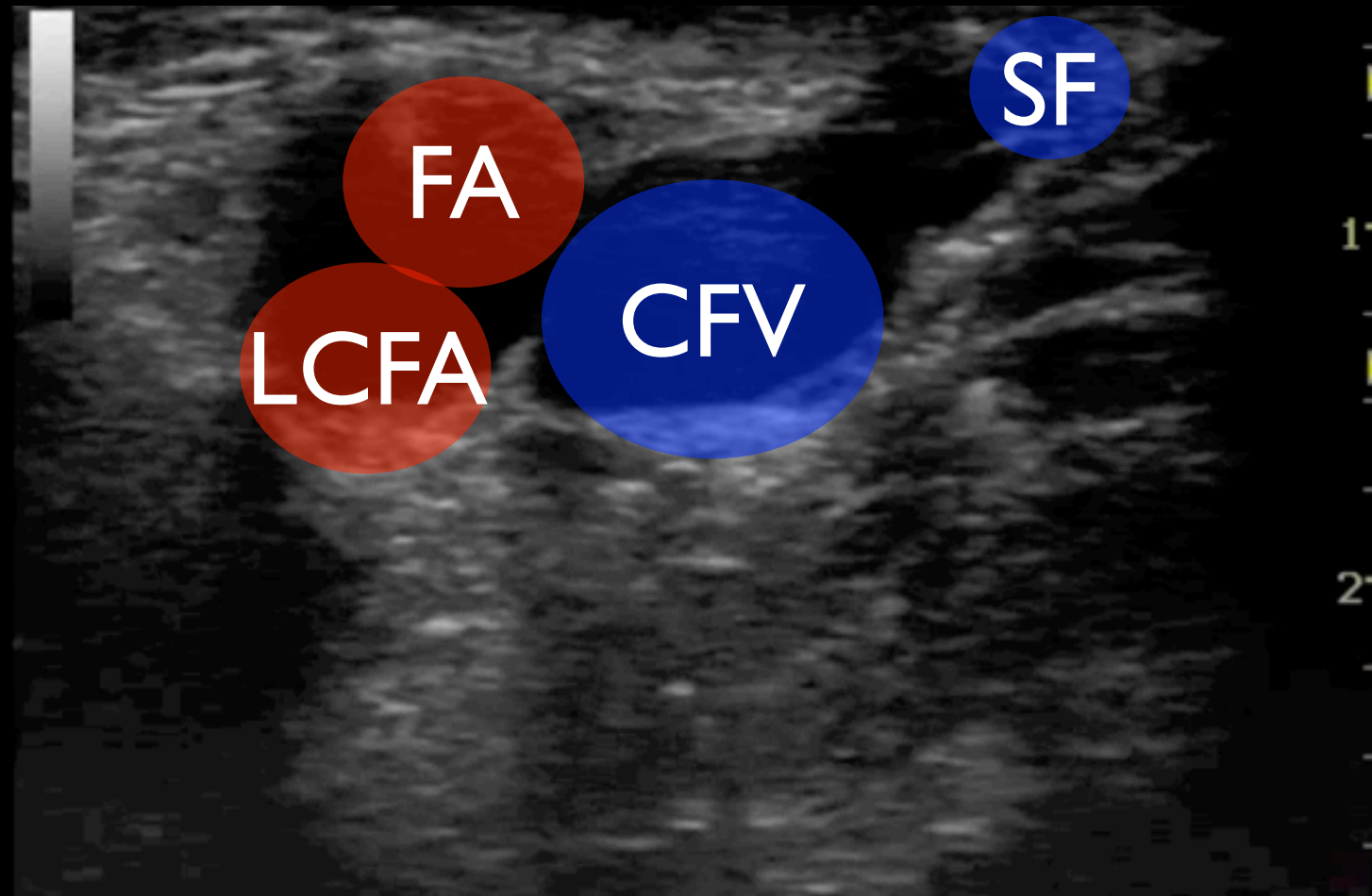
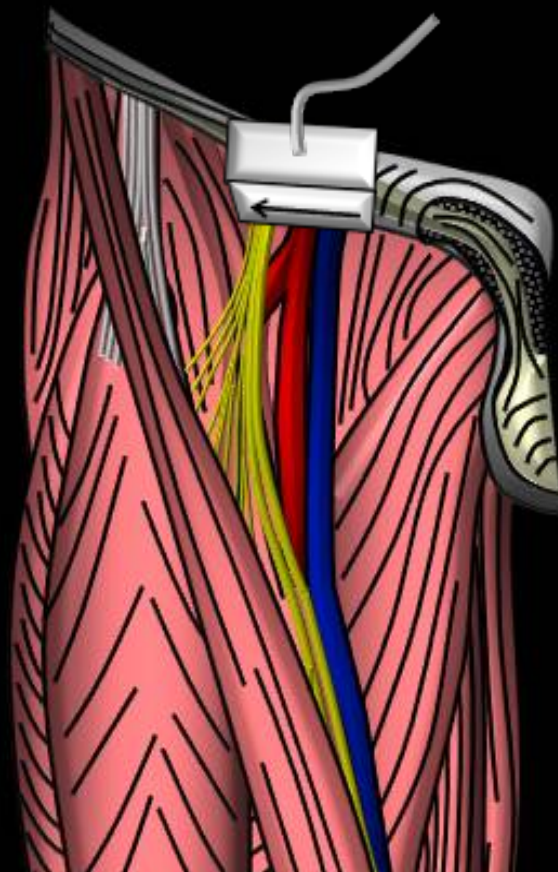
Normal Sonographic Findings

Femoral



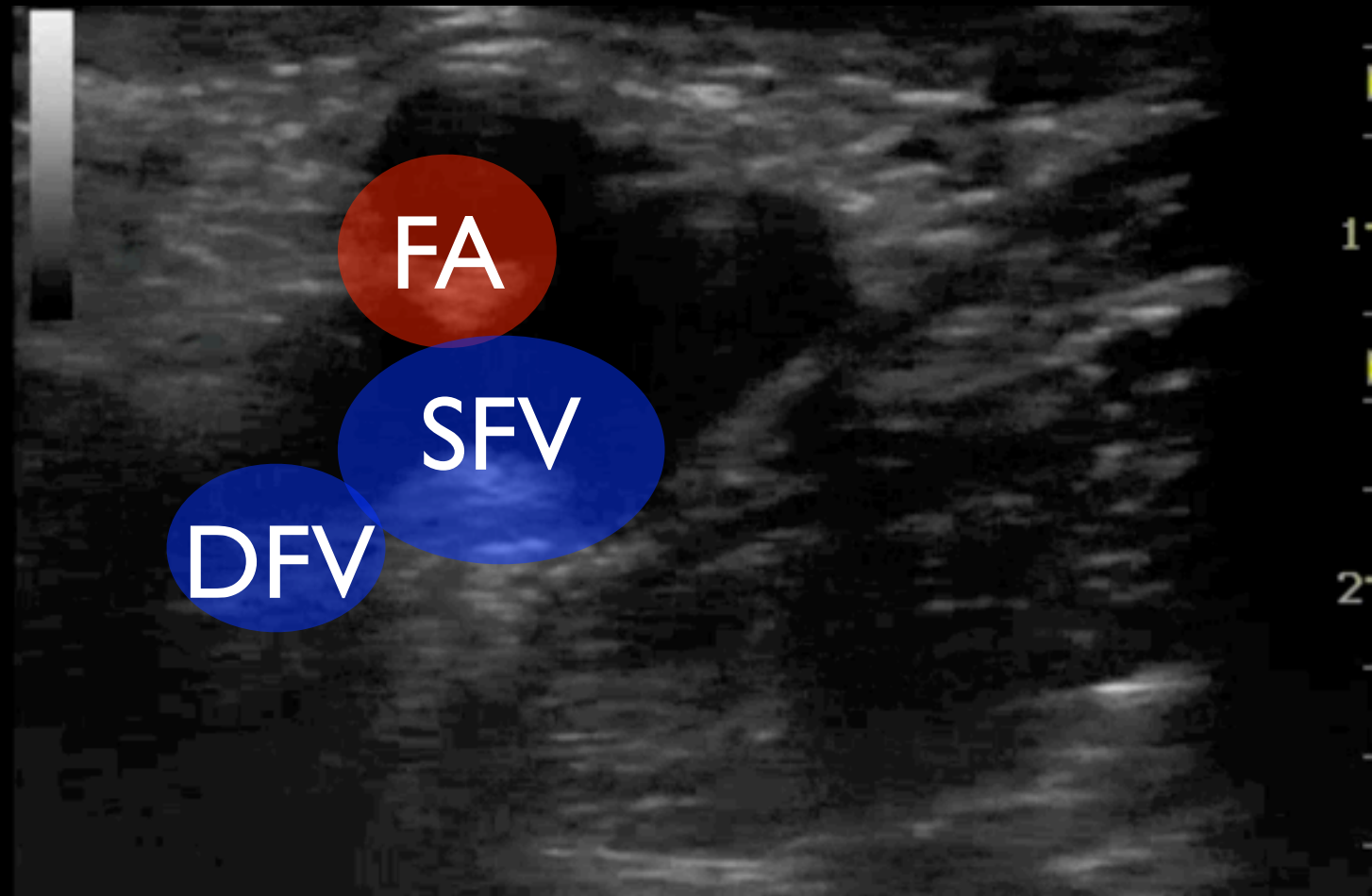
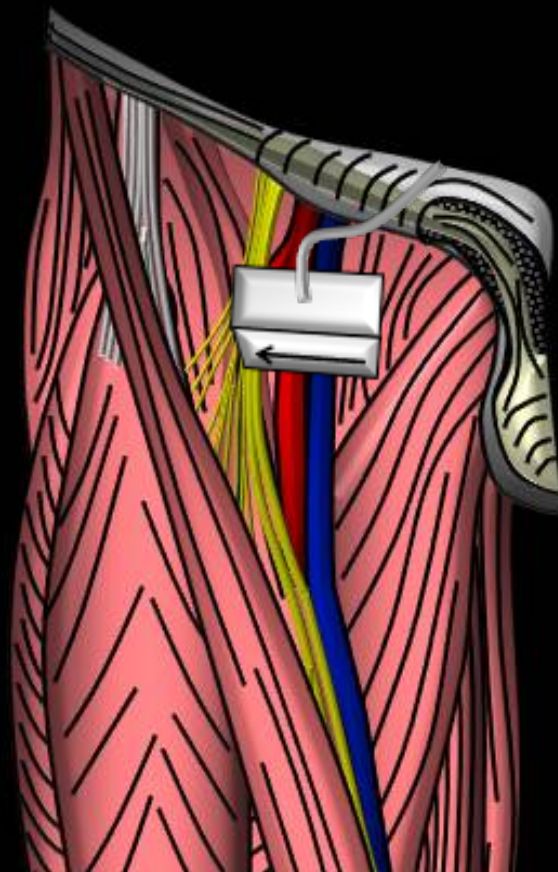
Normal Sonographic Findings

Femoral



Normal Sonographic Findings

Femoral



Normal Sonographic Findings

Artery vs Vein

- Compression
- Color Flow
- Augmentation

Normal Sonographic Findings

Artery vs Vein

- Compression



Normal Sonographic Findings

Artery vs Vein

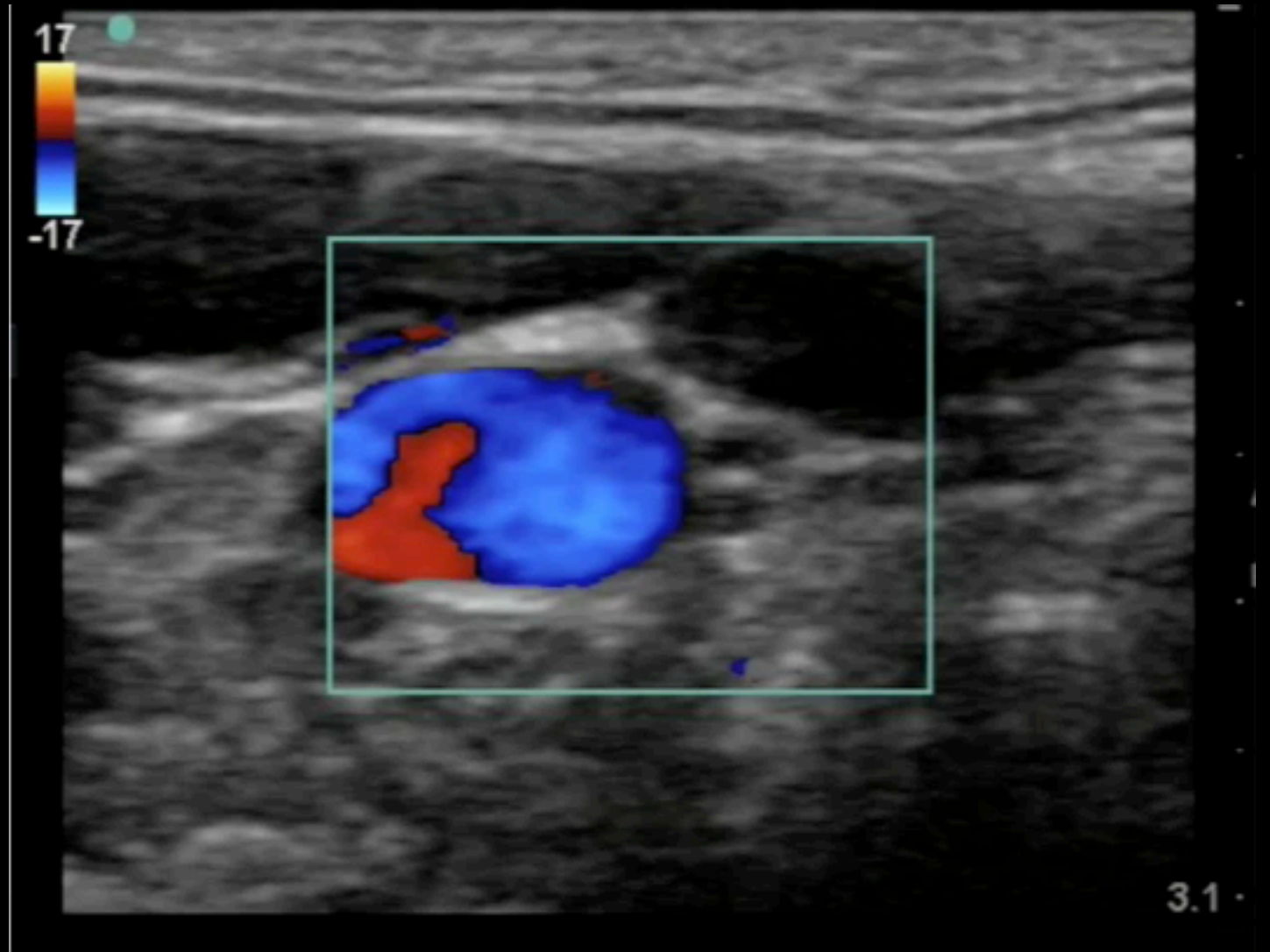
- Compression



Normal Sonographic Findings

Artery vs Vein

- Color Flow



Normal Sonographic Findings

Augmentation

- Increase in venous flow with application of distal manual compression.
- Normal lower extremity veins demonstrate augmentable flows.
- may help differentiate arteries from veins

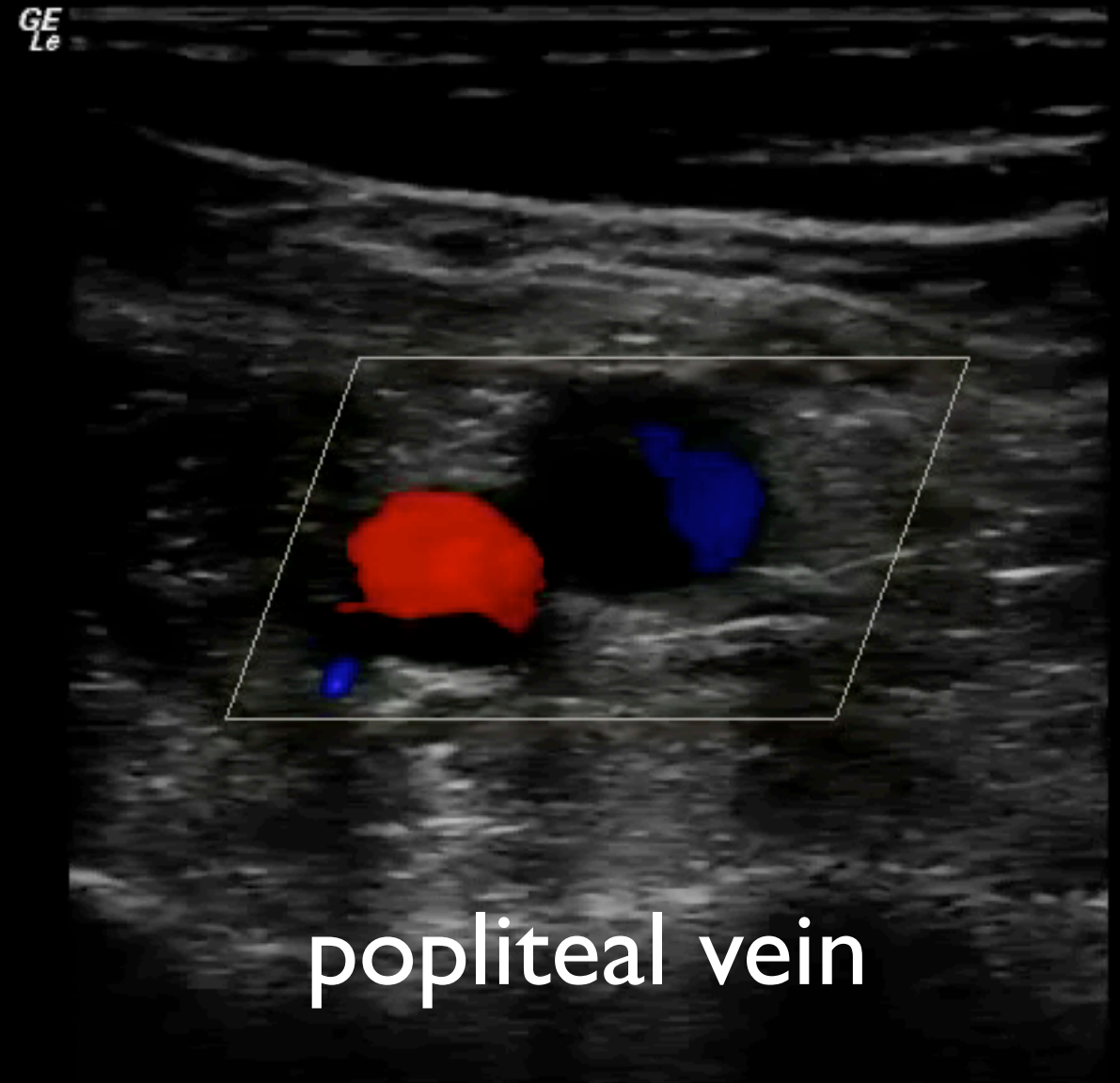
Normal Sonographic Findings

Augmentation

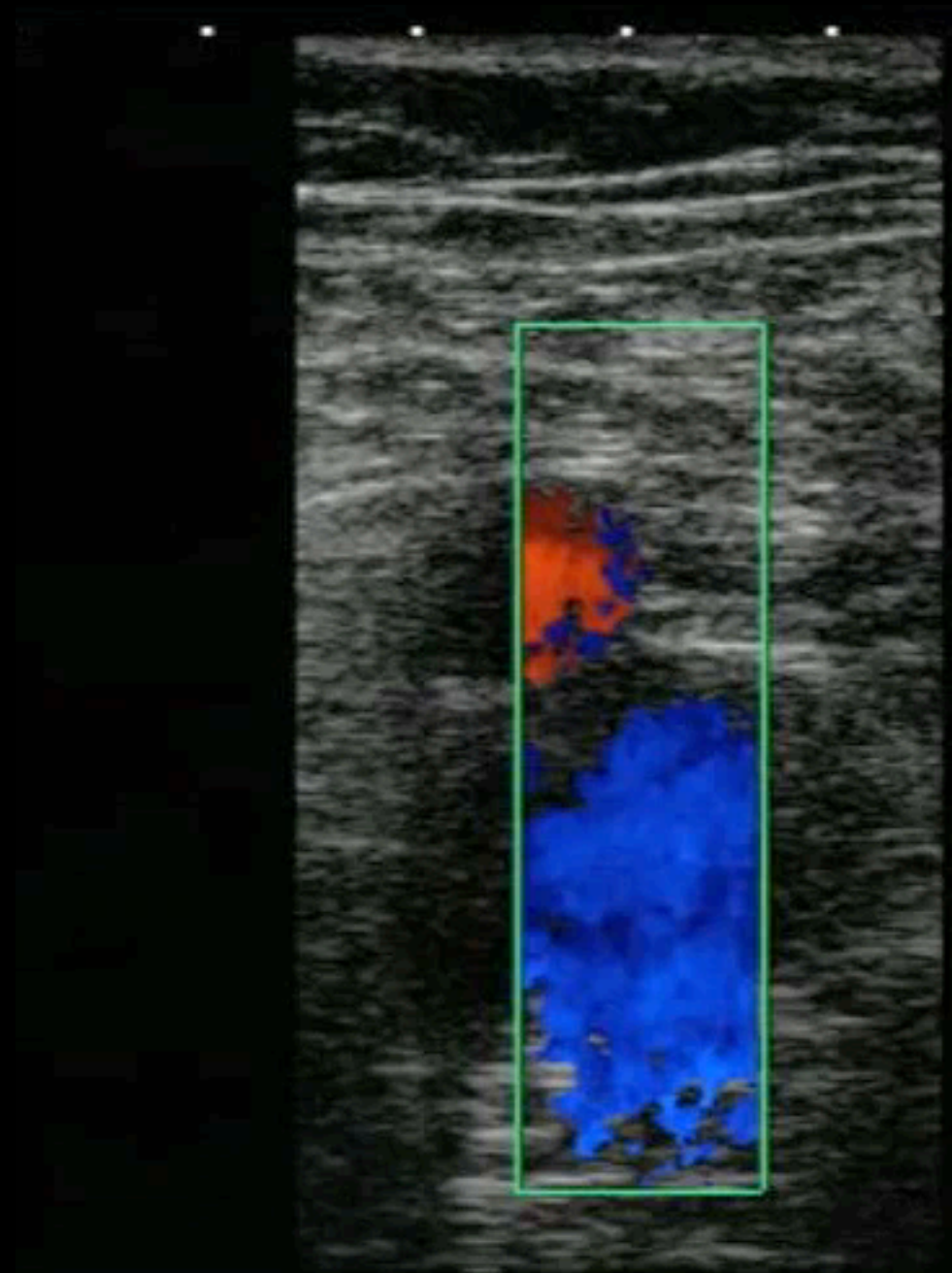


Normal Sonographic Findings

Augmentation



Augmentation



- femoral vein

Pathologic Sonographic Findings

Ultrasonic Findings of DVT

- Intra-luminal echogenic material
- Non-compressible veins
- Decreased response to augmentation

Pathologic Sonographic Findings

Intraluminal Echogenic Material

- hyperechoic material inside vein



Pathologic Sonographic Findings

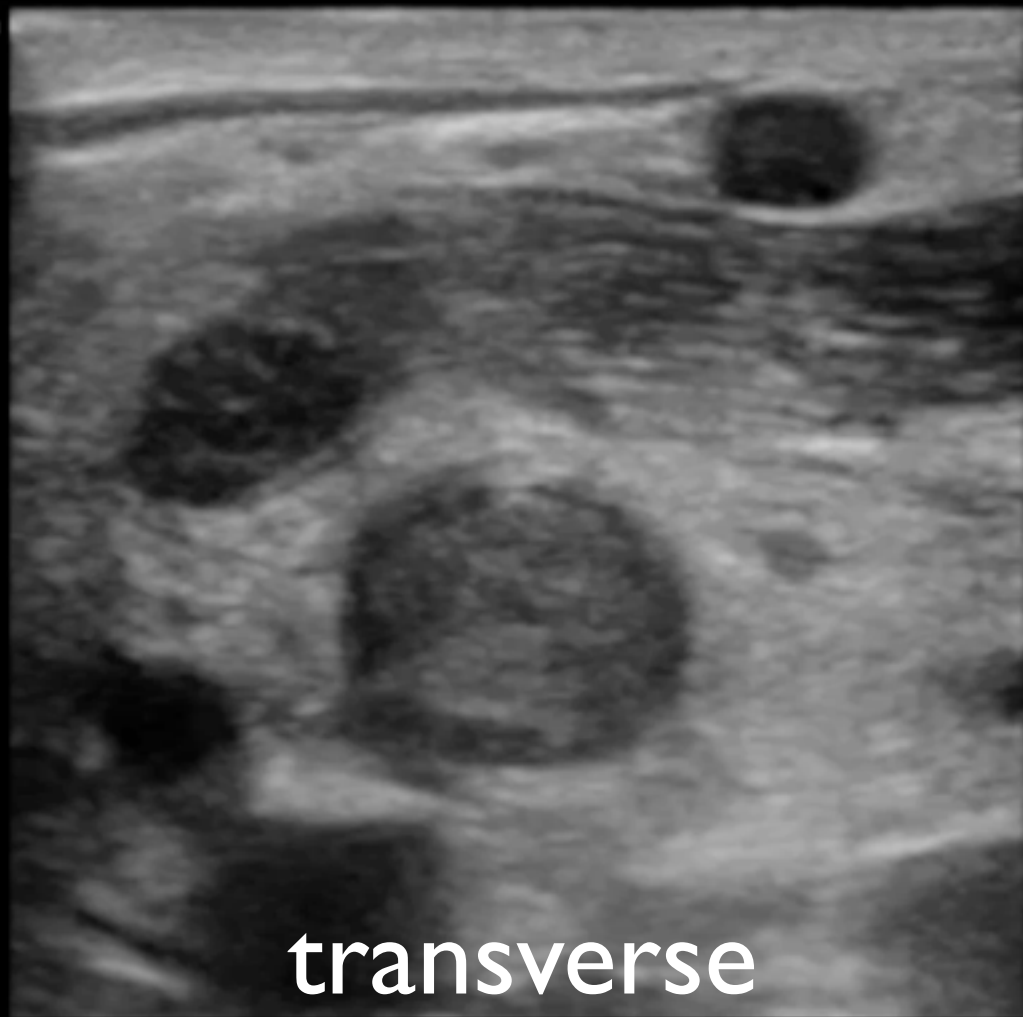
Intraluminal Echogenic Material

- hyperechoic material inside vein



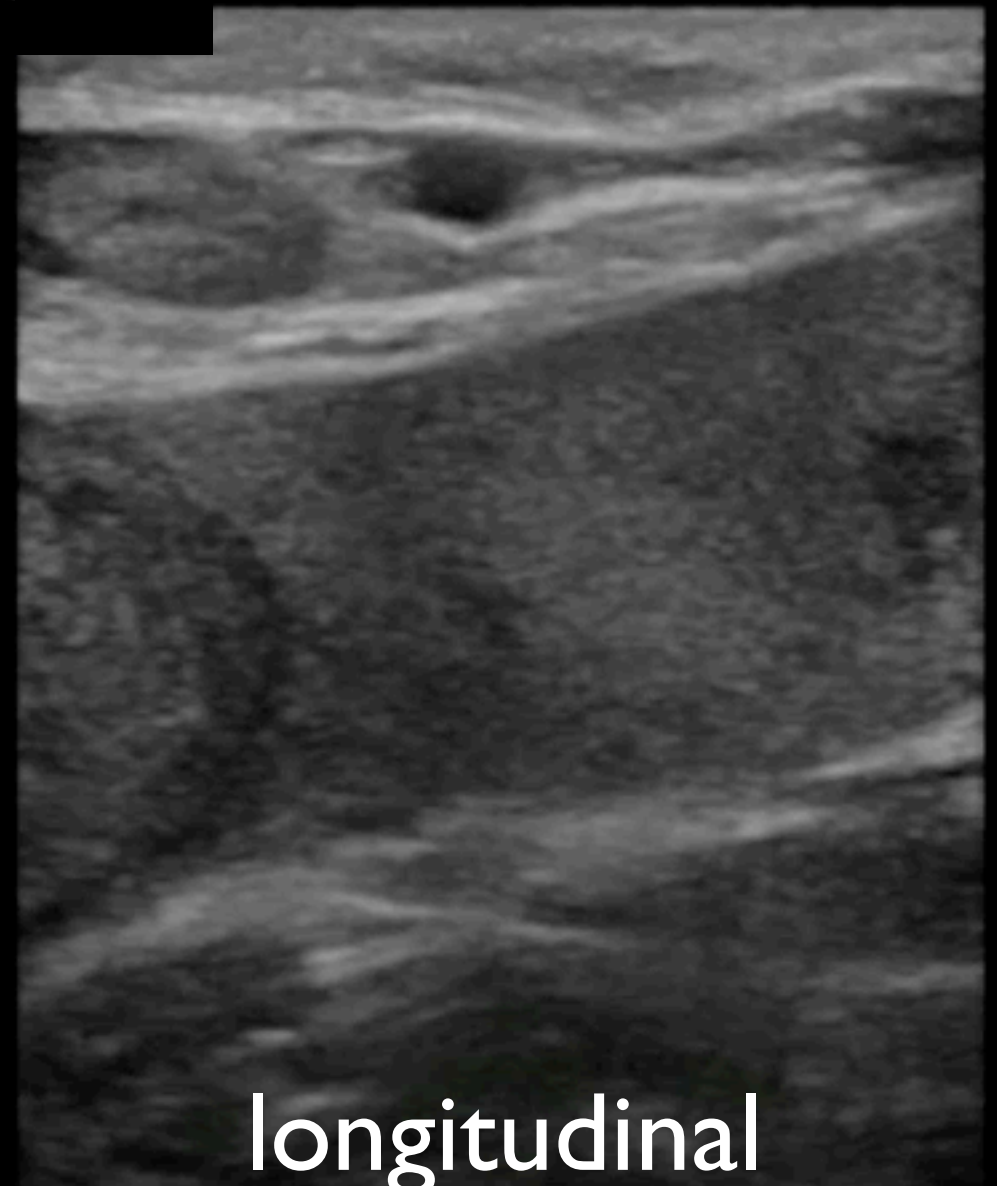
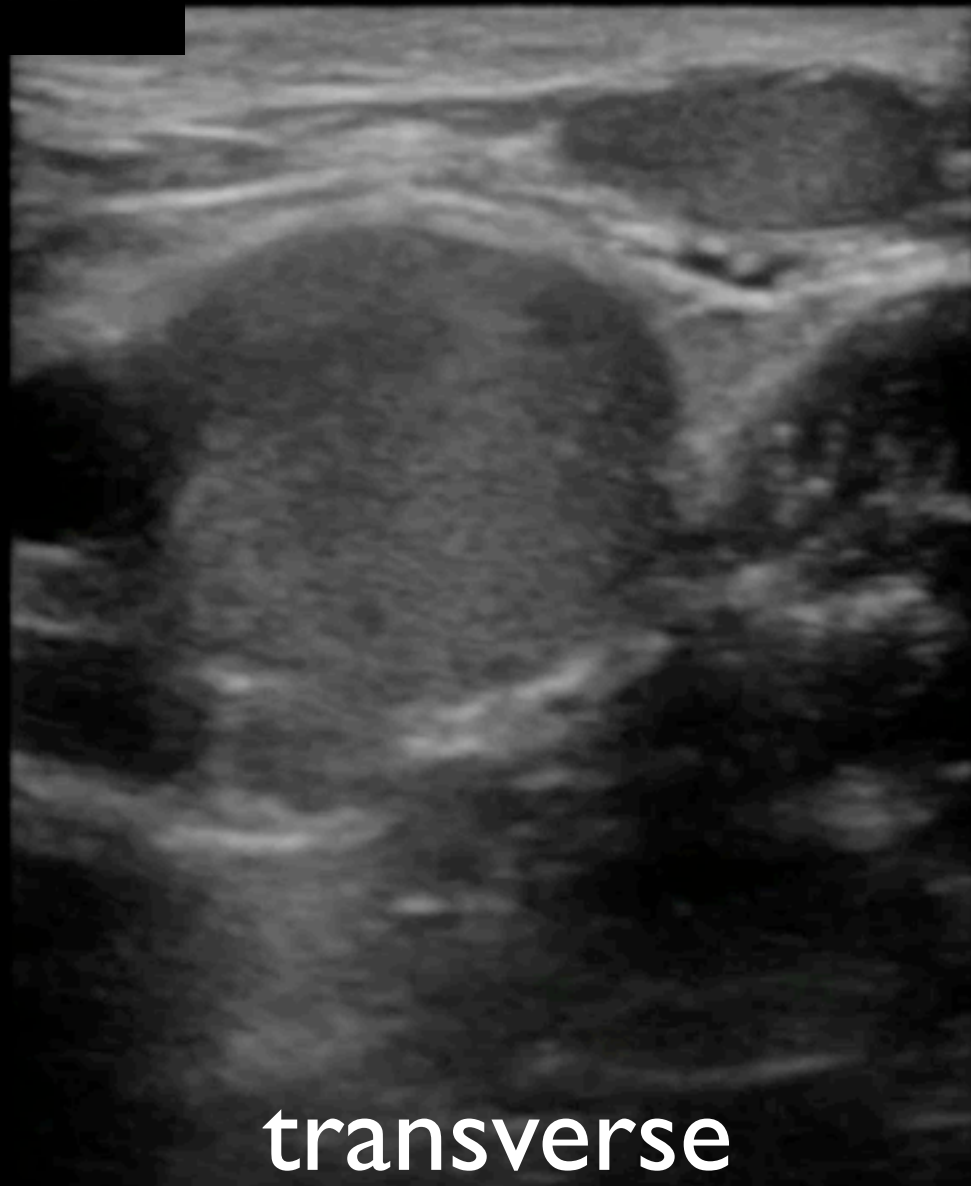
Pathologic Sonographic Findings

Intraluminal Echogenic Material



Pathologic Sonographic Findings

Intraluminal Echogenic Material



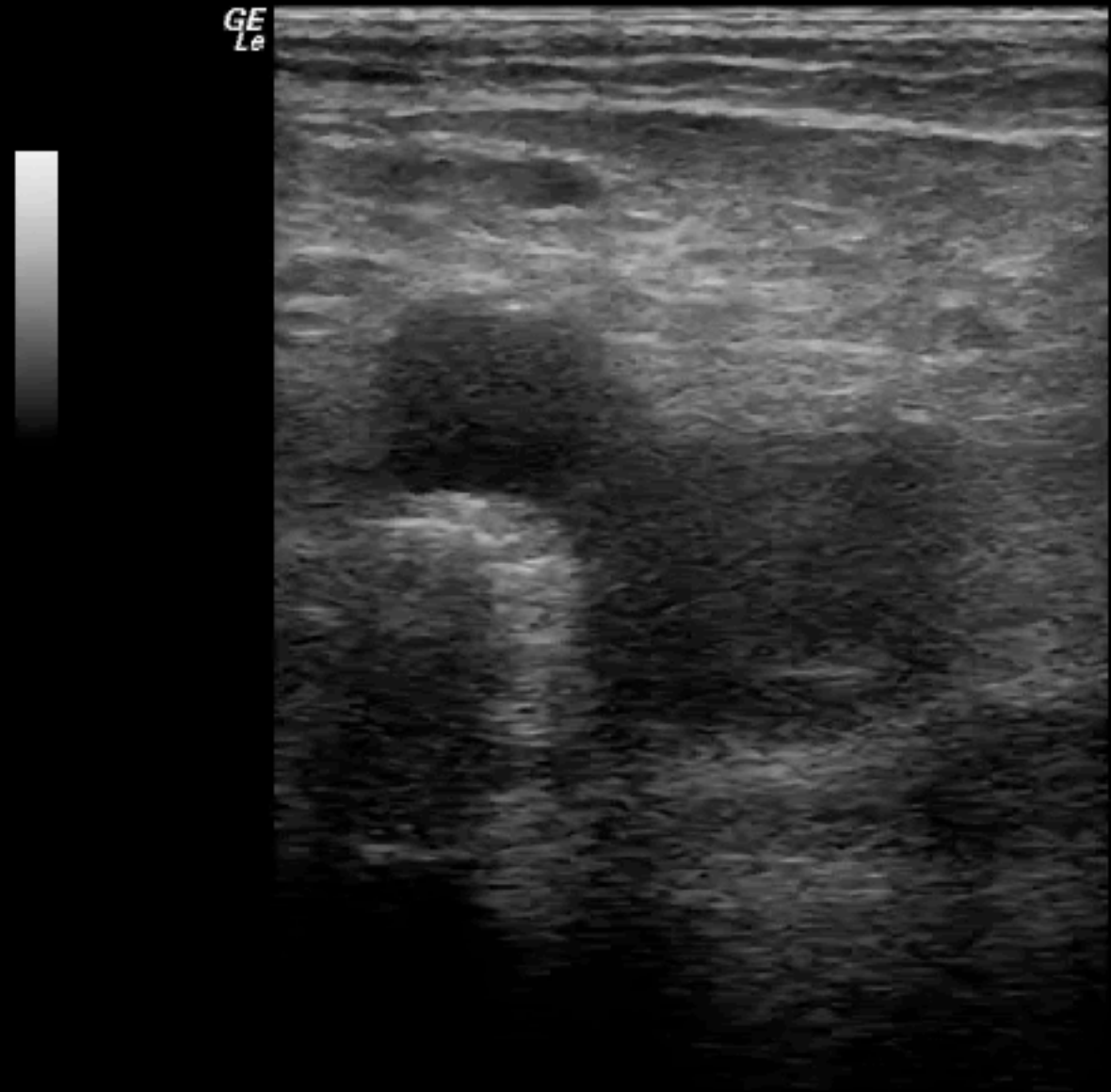
Pathologic Sonographic Findings

Intraluminal Echogenic Material

- Visualization of clot seems would seem to be most direct method of diagnosis
- Clot echogenicity is variable
 - probe frequency
 - age of clot
 - extent of thrombolytic process
- Unreliable
- Slow flowing blood may appear echogenic

Non-Compressible Vein

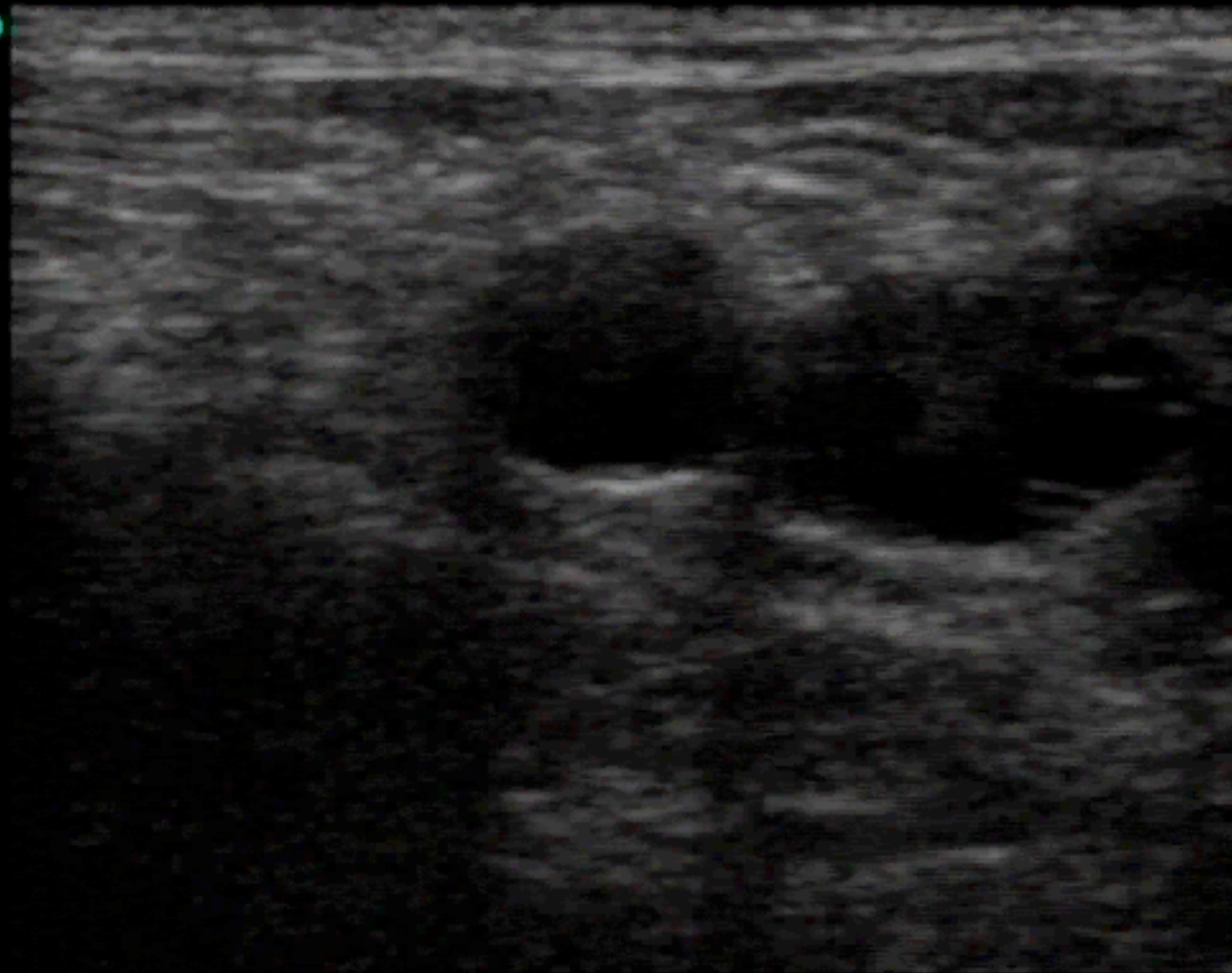
- Failure of walls to completely appose with compression
- Most reliable sign of intraluminal clot



Pathologic Sonographic Findings

Non-Compressible Vein

Gen



- Vas
L38



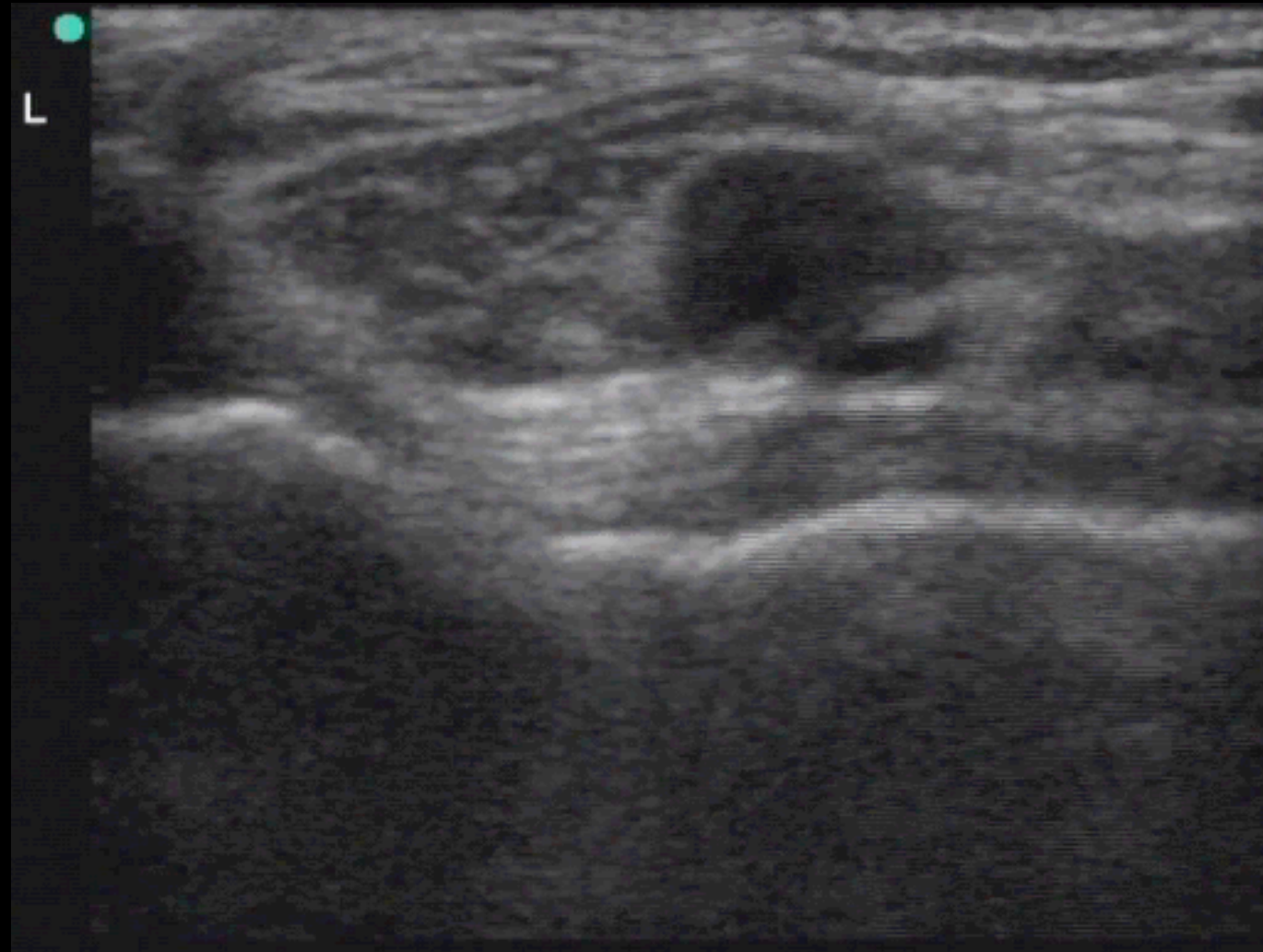
CF
124

MI
0.5

3.3

Pathologic Sonographic Findings

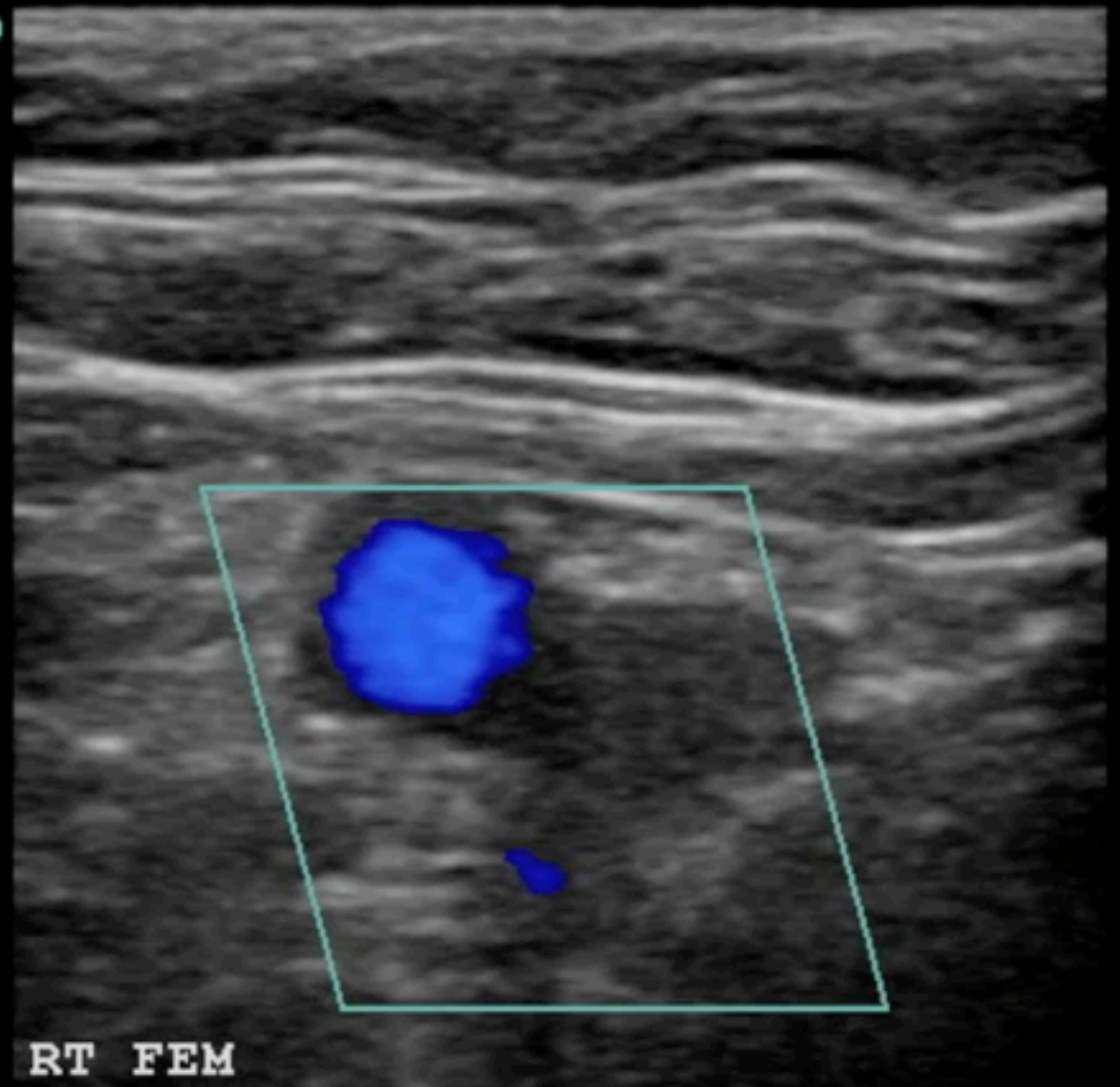
Non-Compressible Vein



Decreased Augmentation

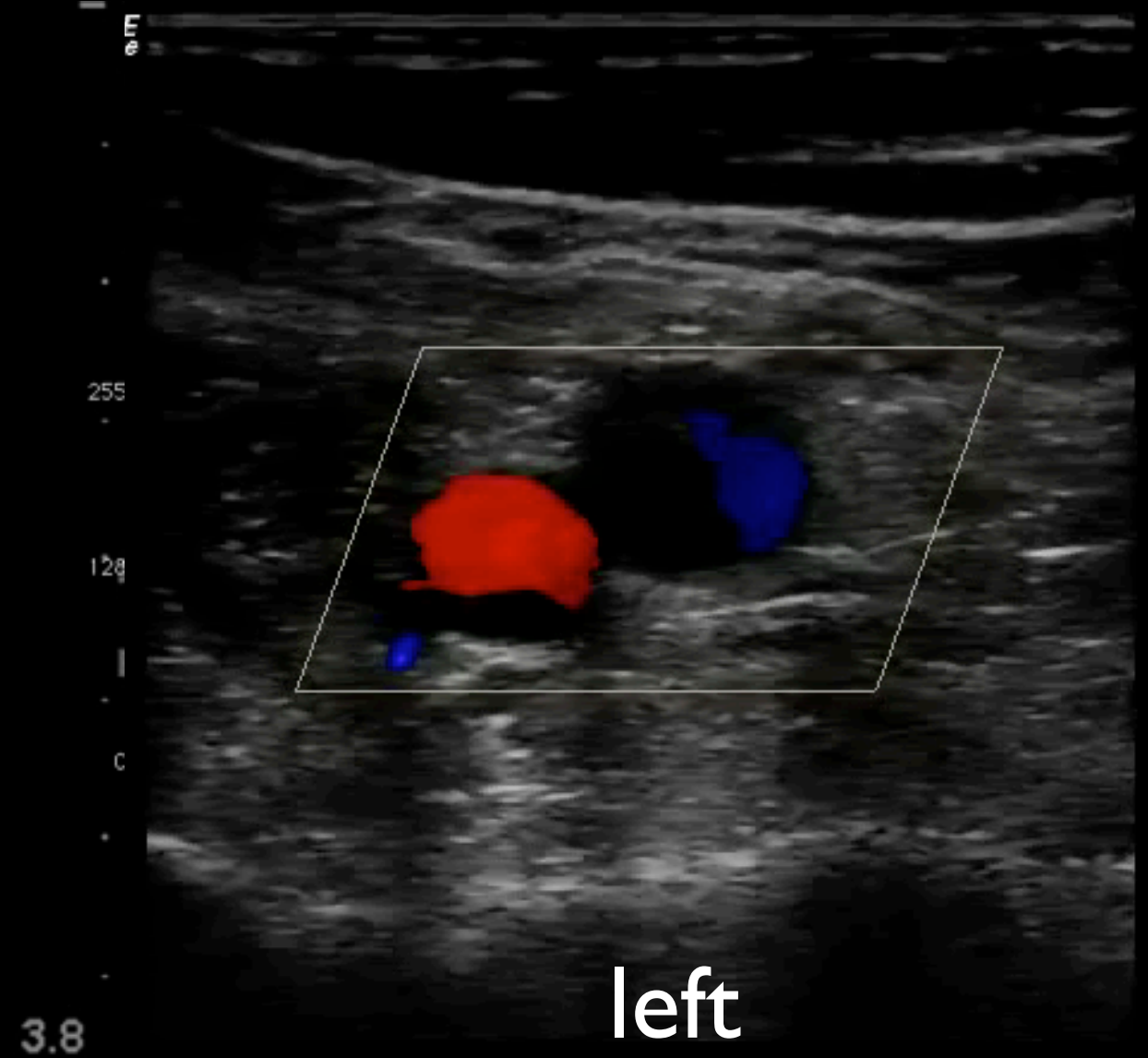
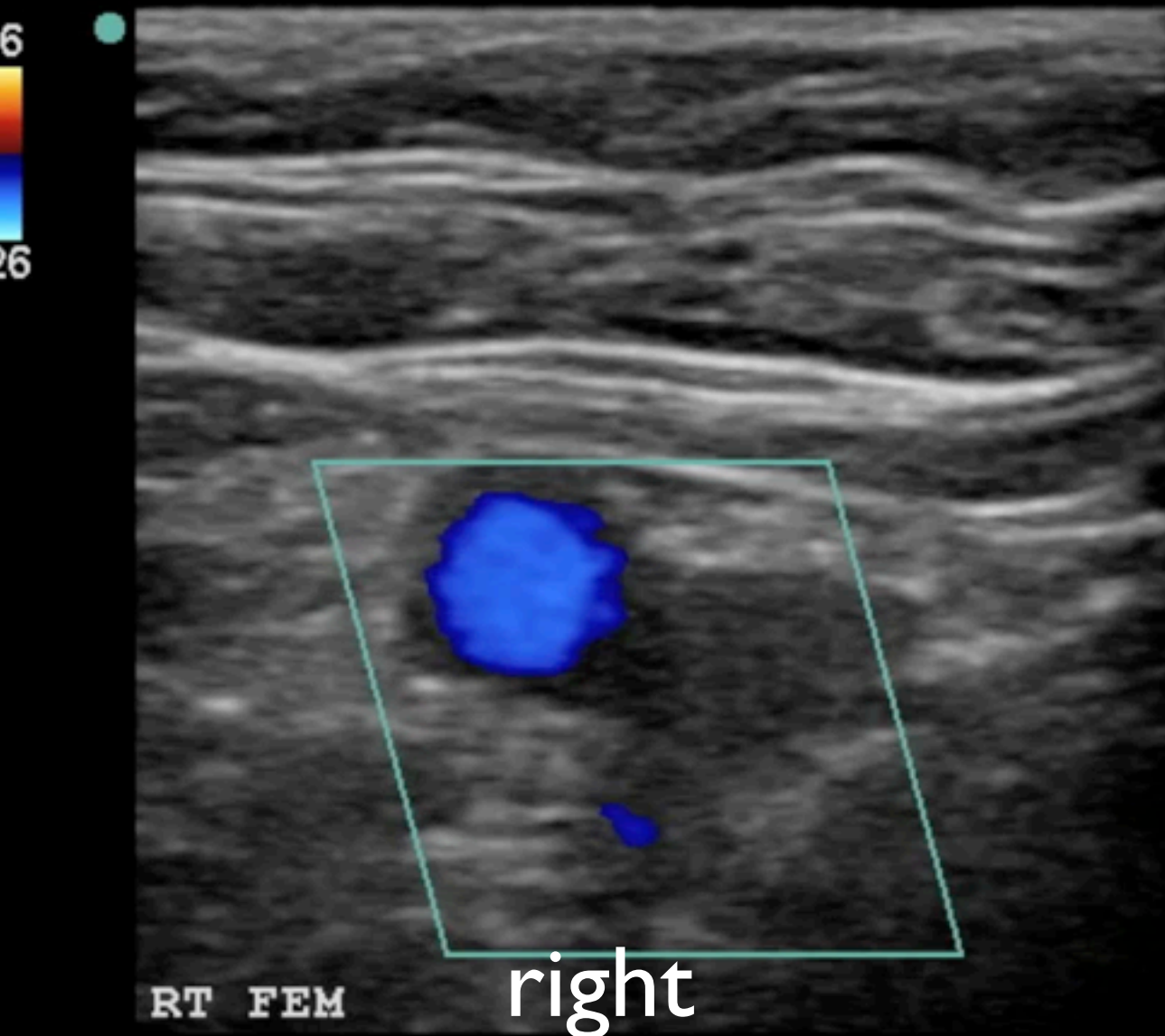
- presence of intraluminal clot reduces augmentation

26
-26



Pathologic Sonographic Findings

Decreased Augmentation



evaluate both sides

Pathologic Sonographic Findings

Diagnostic Criteria for DVT

primary diagnostic criterion	secondary diagnostic criterion
Non-compressibility	Echogenic Thrombus
	Loss of Augmentation

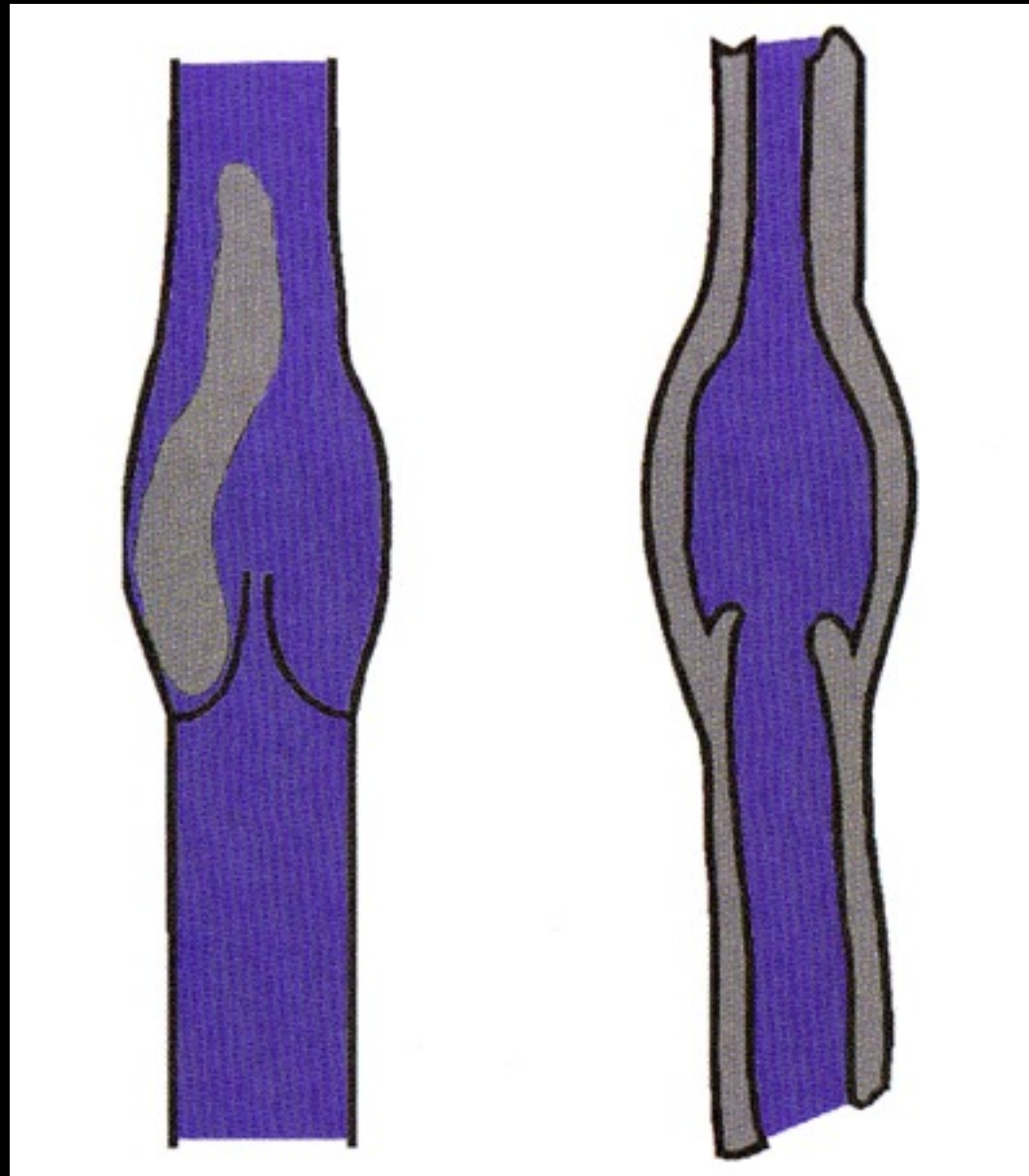
Pitfalls

Acute vs Chronic DVT

- Difficult to differentiate acute vs chronic DVT
- Only reliable method is comparison to previous study
- Older clots:
 - re-cannulize
 - more echogenic
 - vein walls are thinner

Pitfalls

Acute vs Chronic DVT

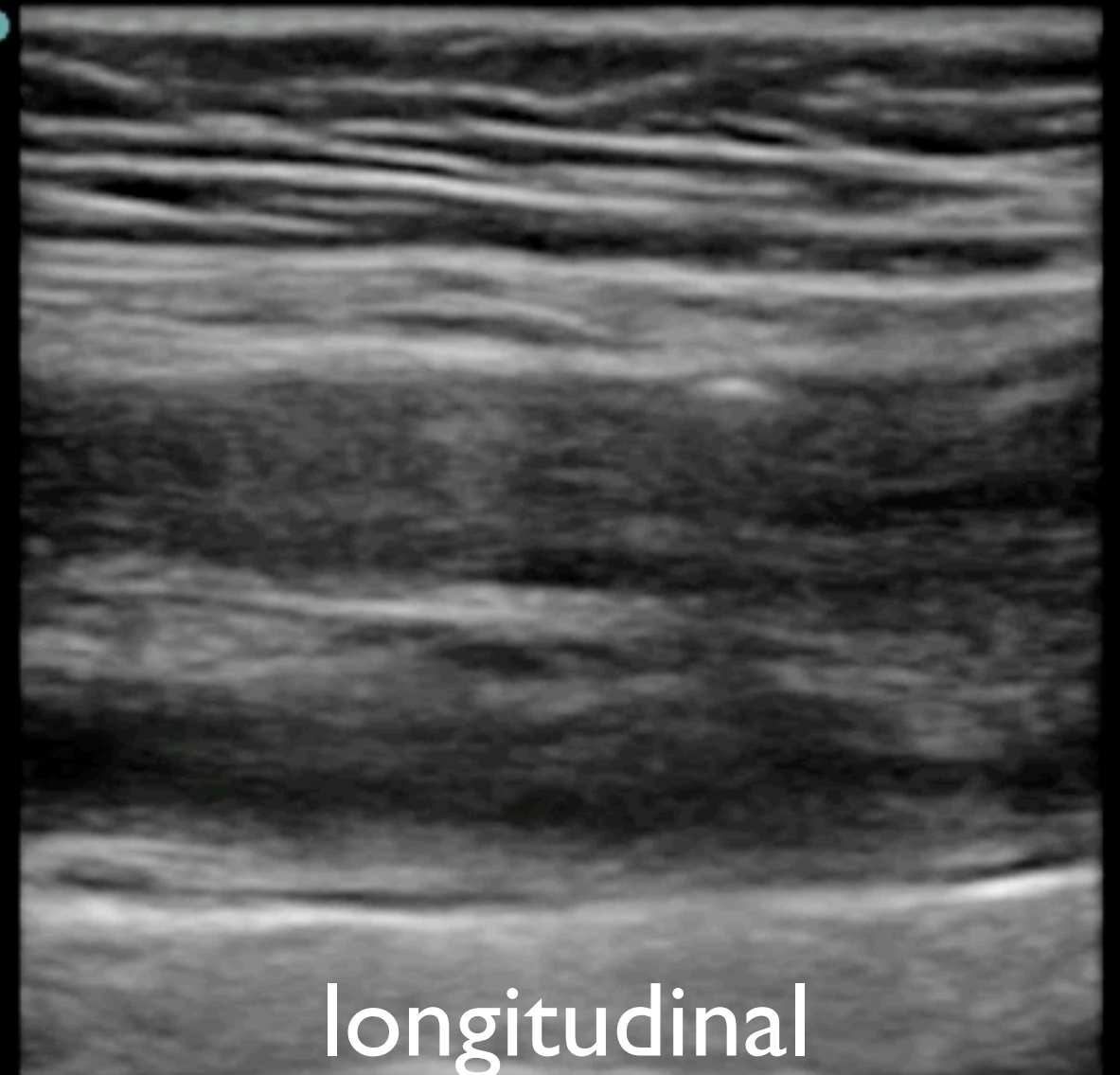
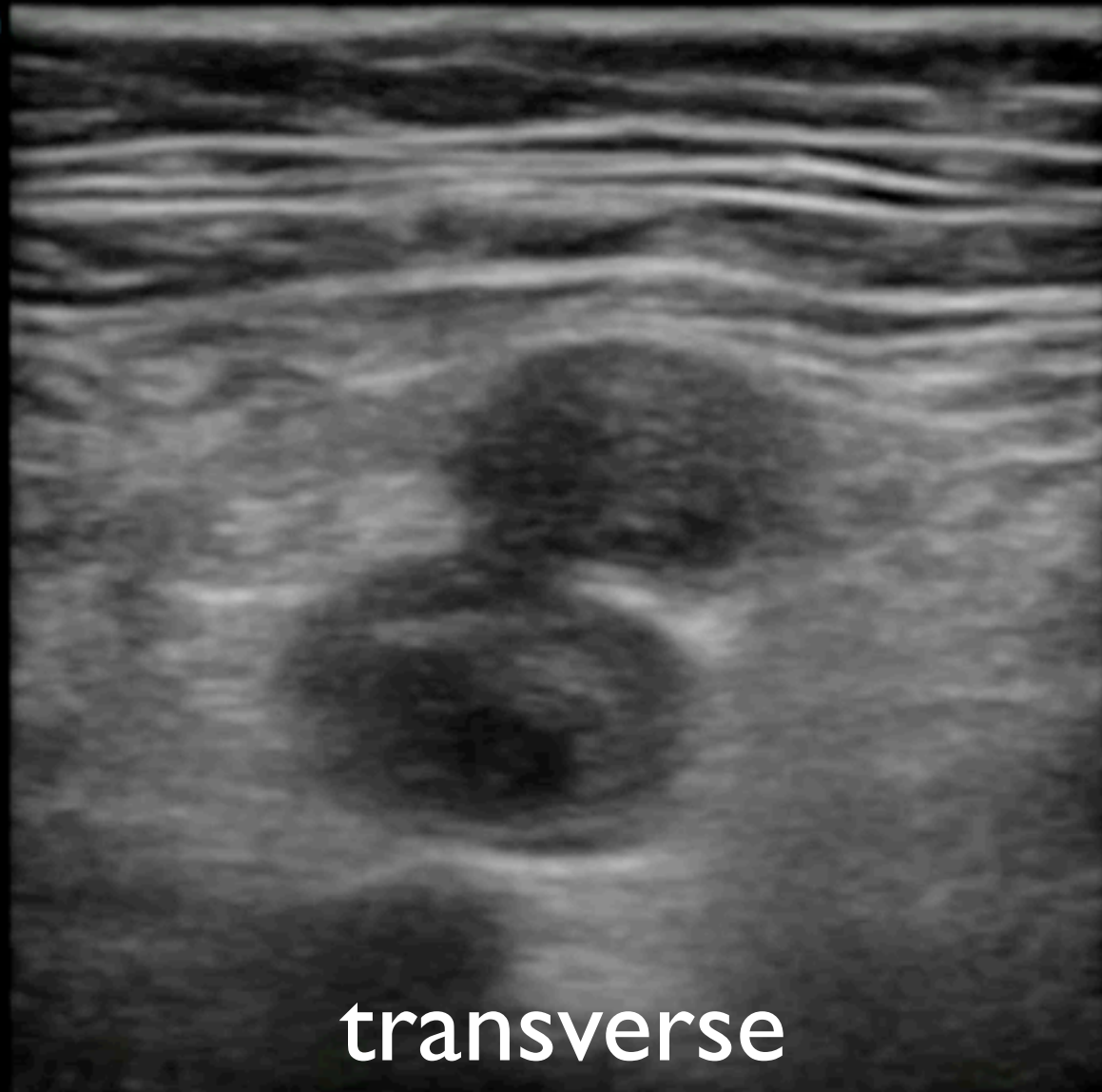


acute

chronic

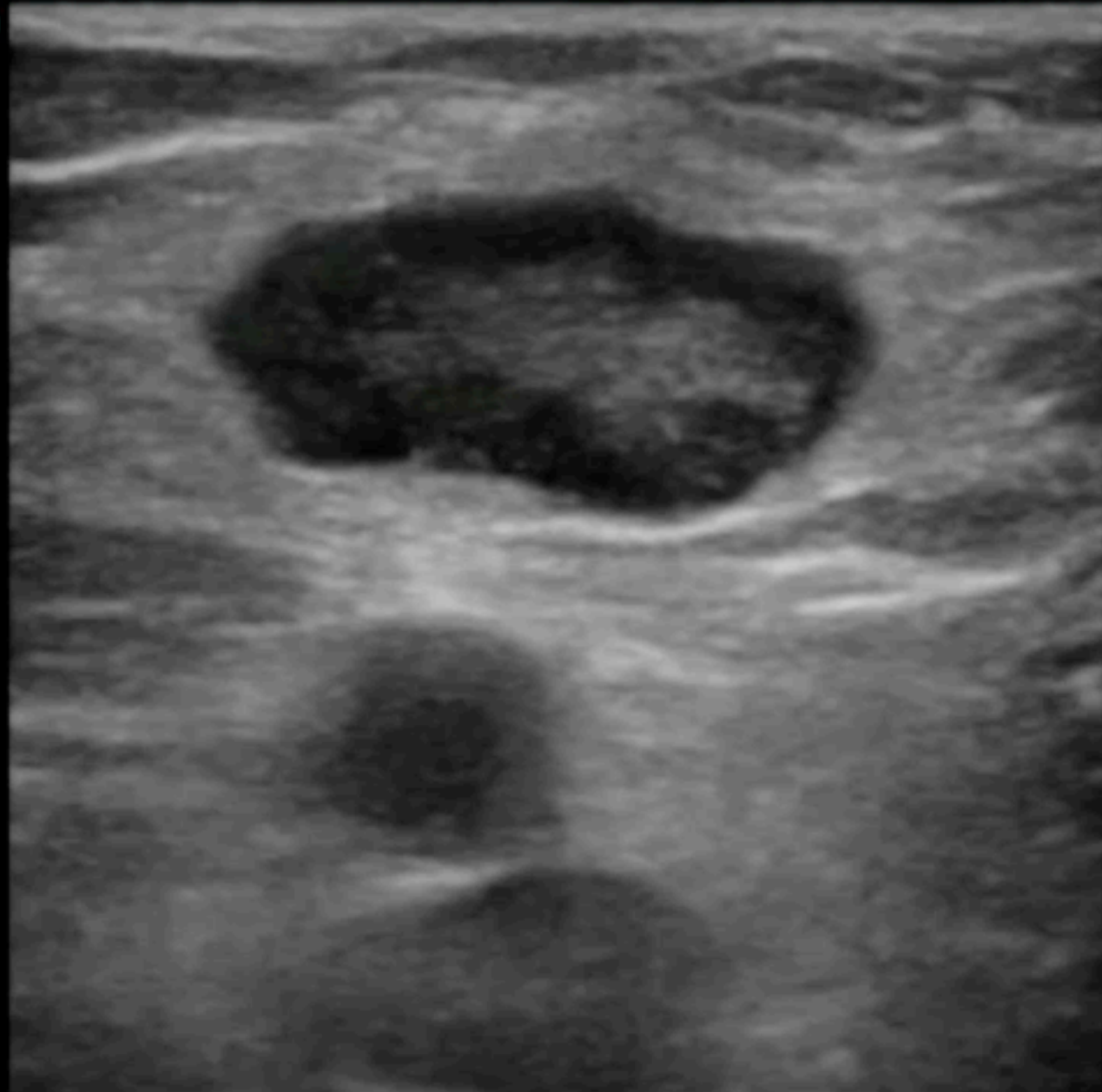
Pitfalls

Acute vs Chronic DVT



chronic DVT

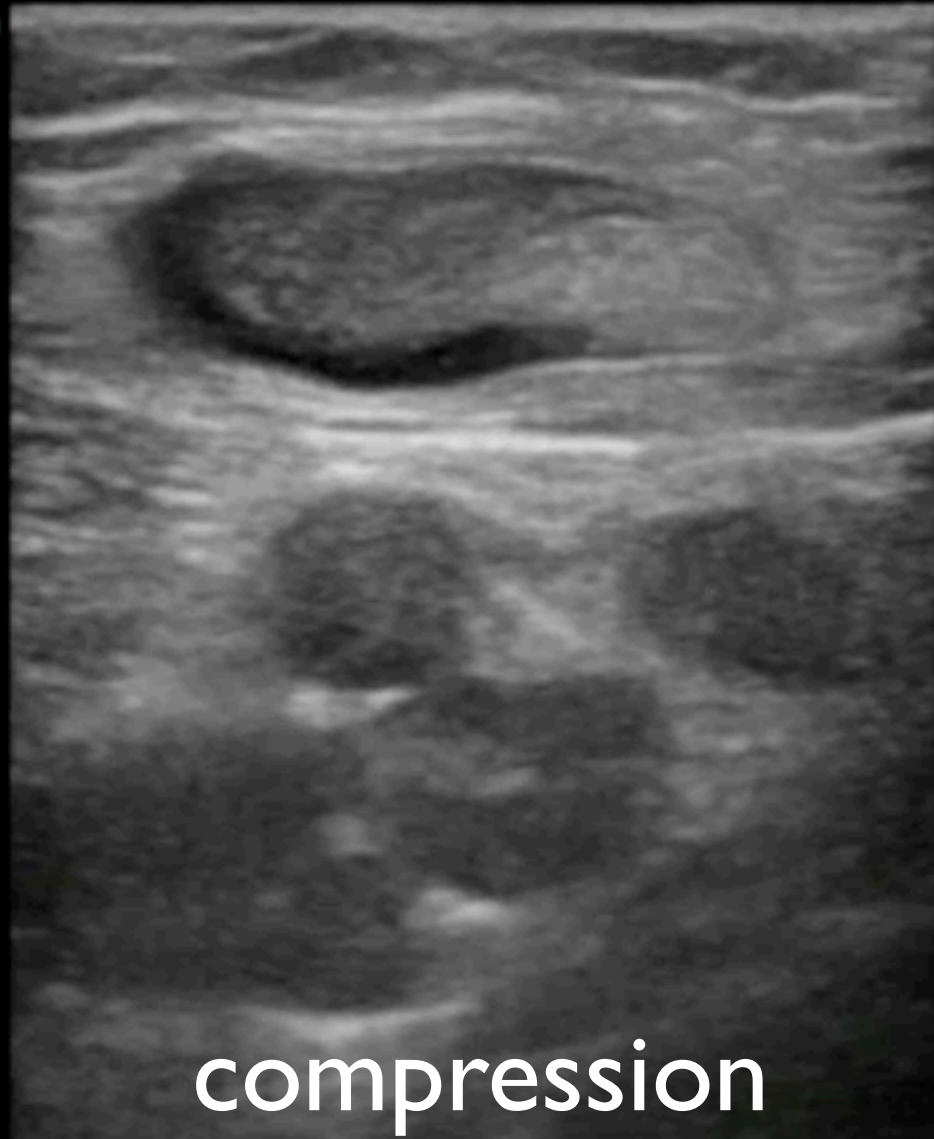
Lymph Nodes



- may be confused for DVT
- especially when inflamed
- have definite endpoints

Pitfalls

Lymph Nodes



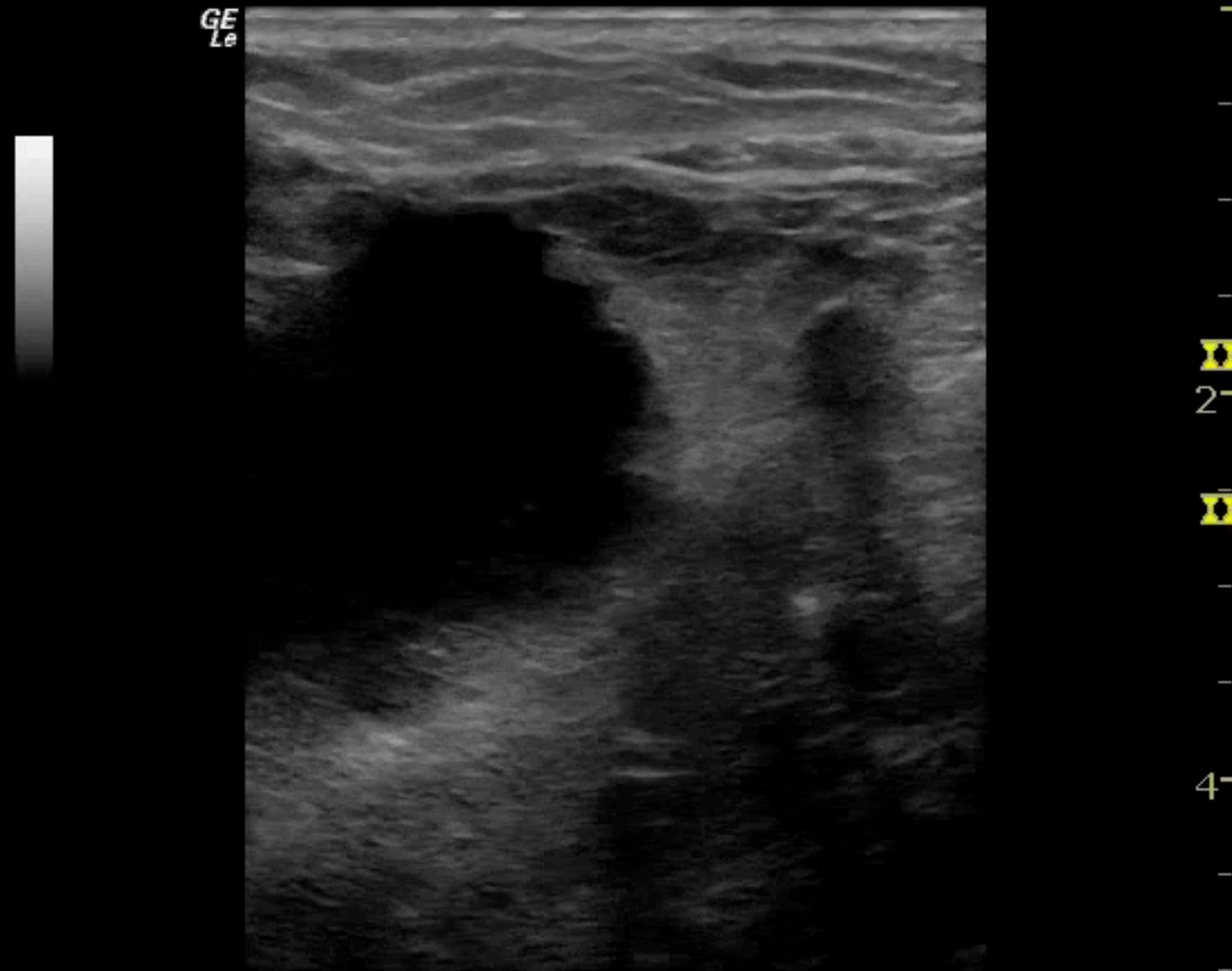
Baker's Cyst

- Posterior cystic expansion of synovial sac
- painful swelling



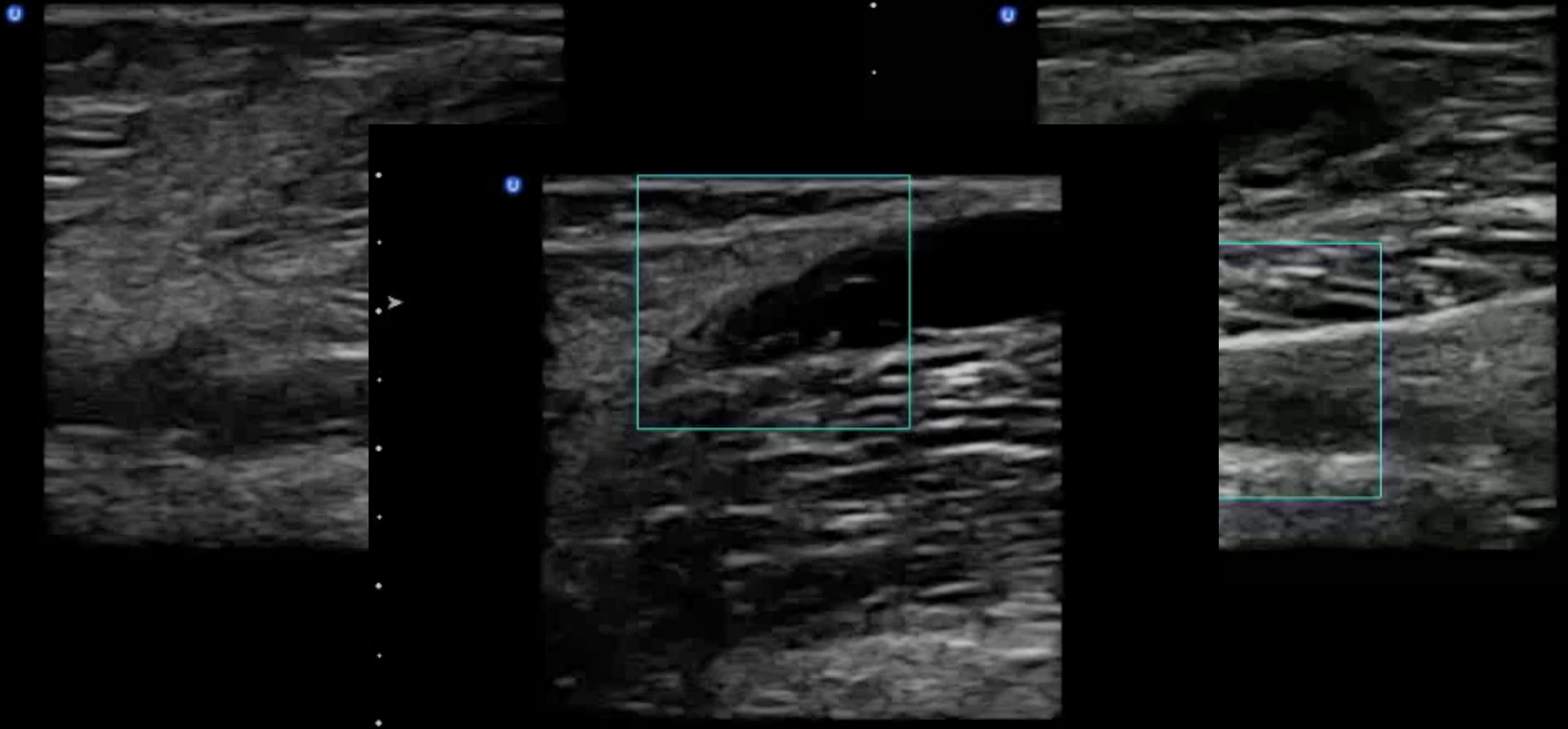
Pitfalls

Baker's Cyst



Pitfalls

Baker's Cyst

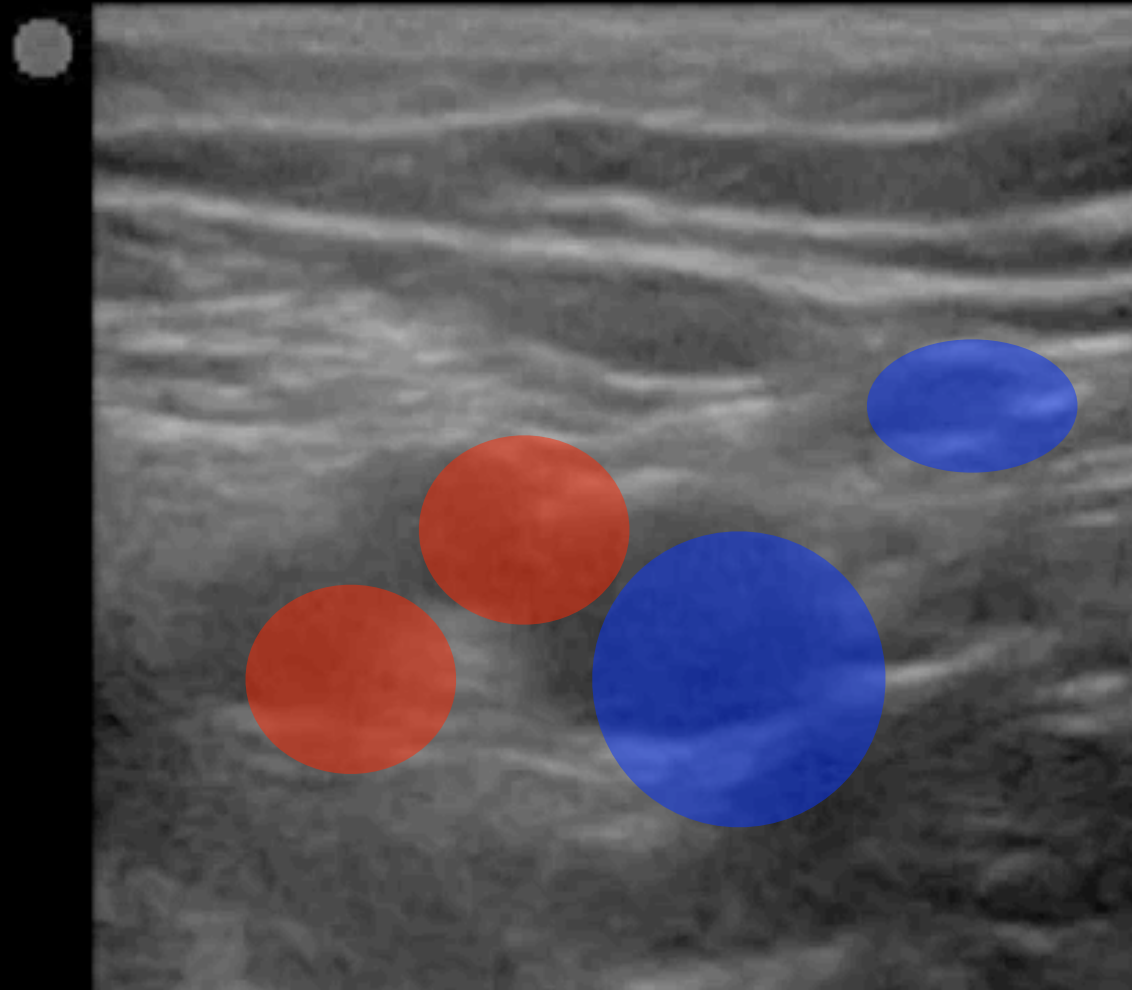


Duplicated Vessels

- A high percentage of patients will have duplicated vessels (arteries or veins)
- Other areas of the body that may have duplicated vascular systems include:
 - femoral vessels
 - brachial vessels
- Examiner is obligated to examine BOTH venous structures

Pitfalls

Duplicated Vessels



Pitfalls

Reliable US findings

- Compression is the most reliable finding
 - Patients with DVT may lack:
 - Intraluminal echogenic material
 - decreased response to augmentation

Cases

Case #1

- 25 y/o F with R. calf pain and swelling
- law student, active and physically fit
- no PMHx
- Vital signs normal, O2 sat 98% RA
- R. calf tender, no erythema.
- R. circumference 1.5cm larger (h/o remote L. knee injury)

Cases

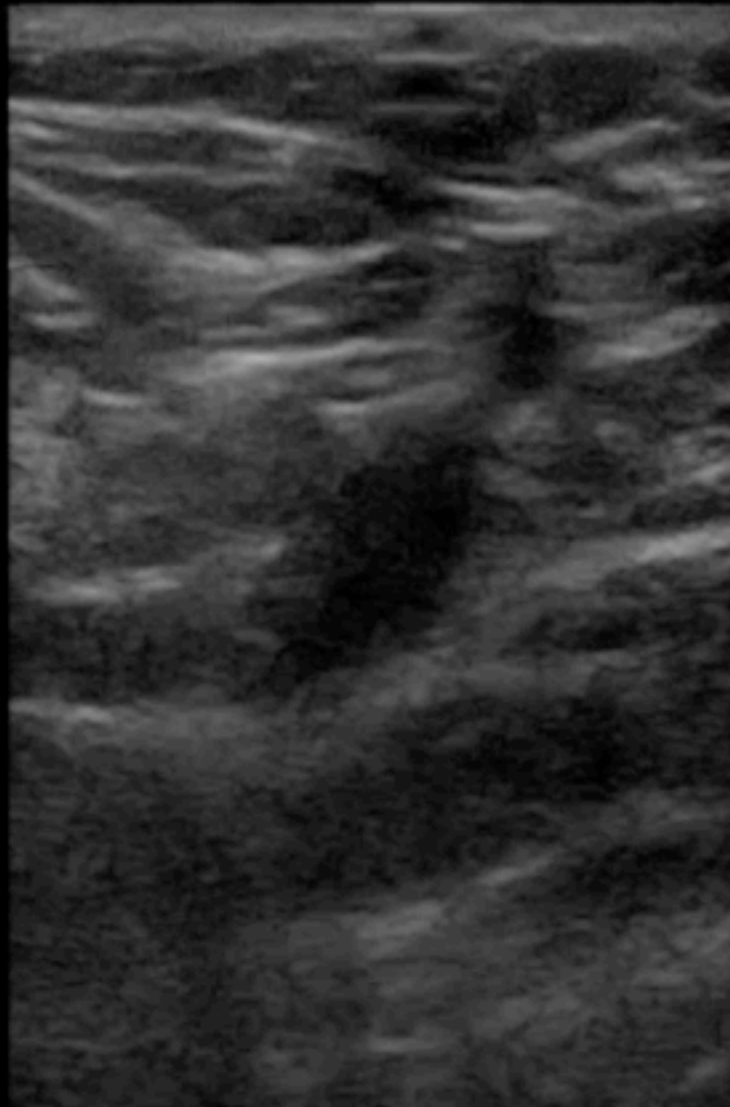
Case #1

- Radiology US not available on Saturday
- Pt refuses admission for anticoagulation or formal study

Cases

Case #1

RTFEM ●



compresses



RTFEM ●



augments

No DVT

Cases

Case #1

- Low risk patient, but exam and hx suggestive
- ED ultrasound excludes proximal DVT
- Allows confident discharge with follow up instructions for repeat ultrasound to exclude propagation of calf vein thrombosis

Cases

Case #2

- 60 y/o M, h/o COPD, CAD, HTN
- vague LLE pain
- typically has pain in either/both legs, requests pain rx for pain meds
- reports mild chronic swelling, no new swelling

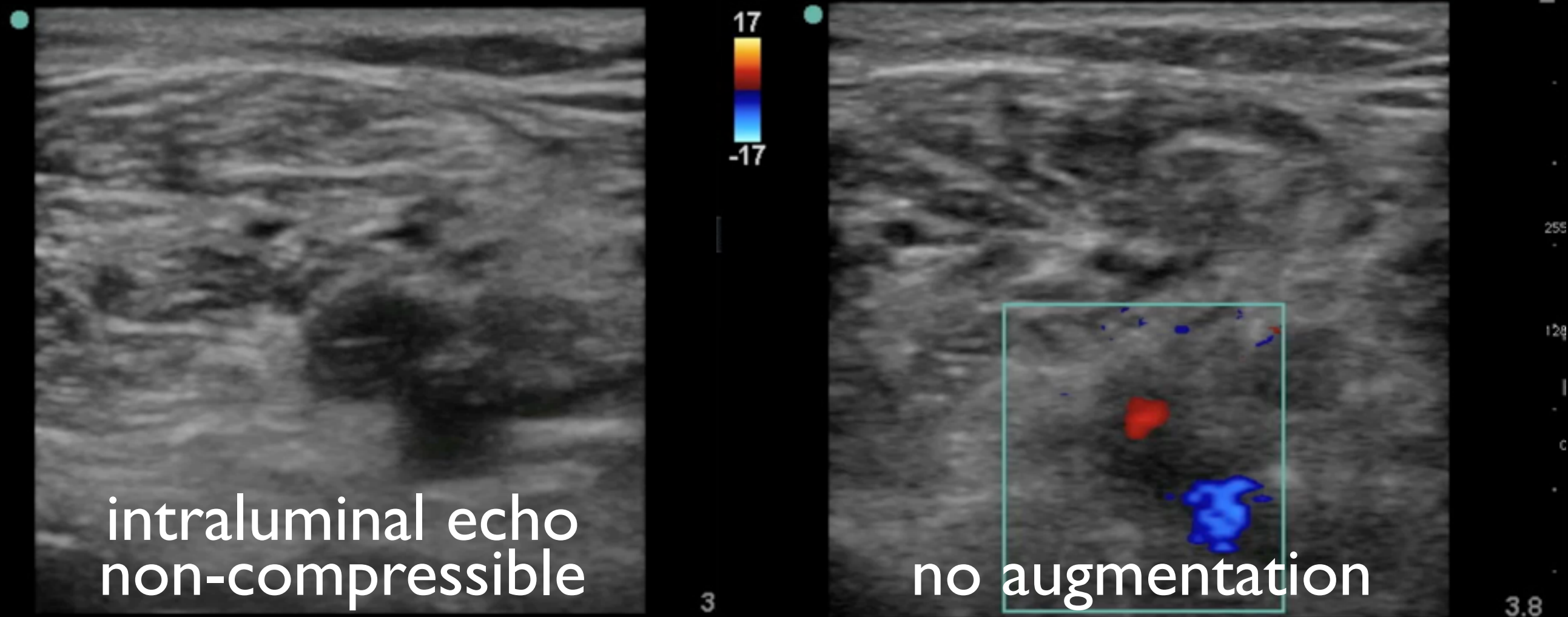
Cases

Case #2

- Appears comfortable, normal vitals signs.
- Chronic venous stasis changes, more subjective L. tenderness
- mild non-pitting edema, no erythema
- Formal US not available for several hours

Cases

Case #2



Positive for DVT

Case #2

- Pt admitted, started on anticoagulation
- several confounding issues but deserved ultrasound
- time saved in diagnosis

Cases

Case #3

- 22 y/o F, h/o sickle cell disease c/o L. lower leg swelling and pain
- Discomfort x4 days, today noticed swelling, redness, pain

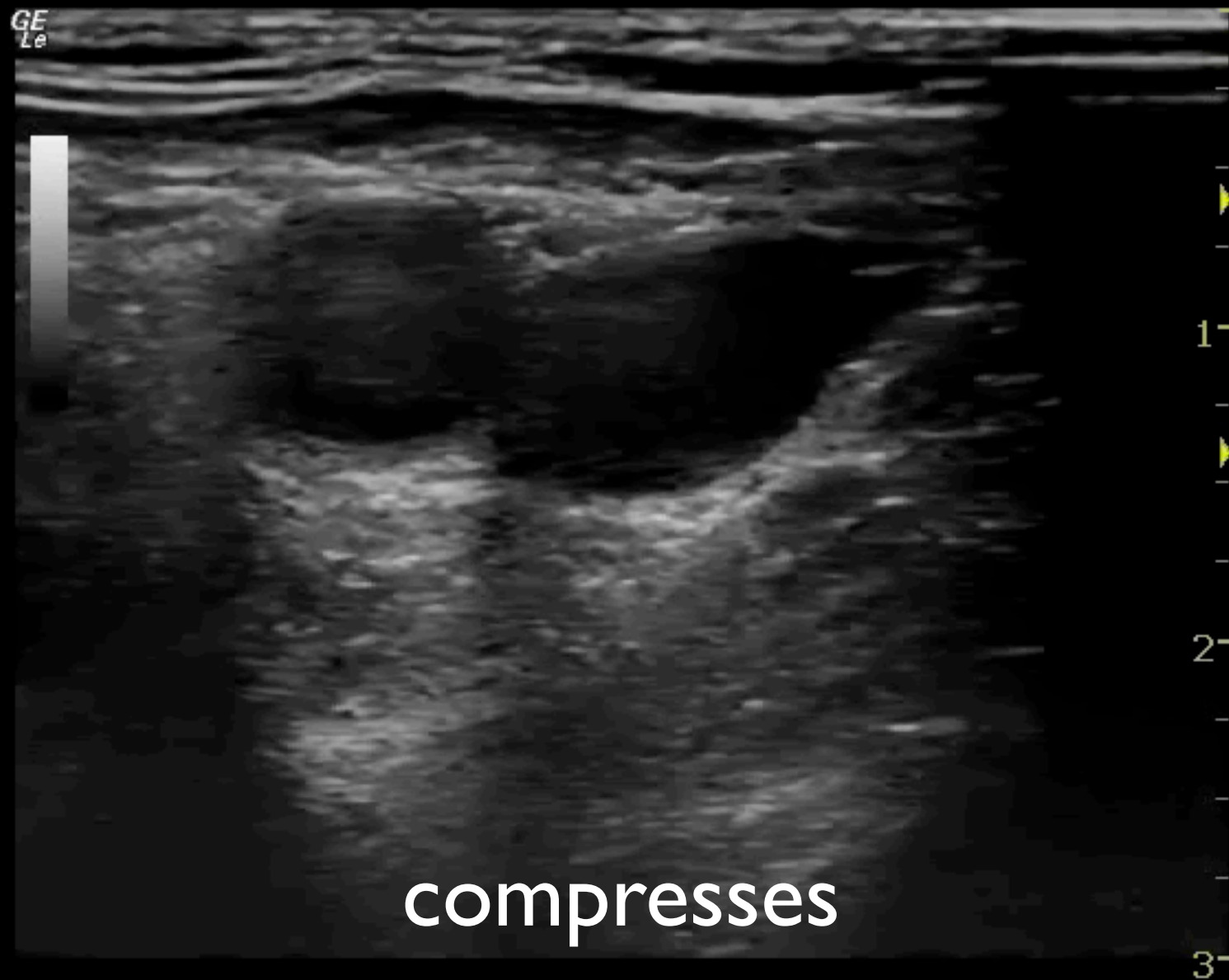
Cases

Case #3

- Normal vitals, temp 100.0 (37.7)
- erythema, warmth anterior shin, non-pitting edema. Sensitive to touch.
- calf mildly tender
- Patient seen at night, formal ultrasound unavailable

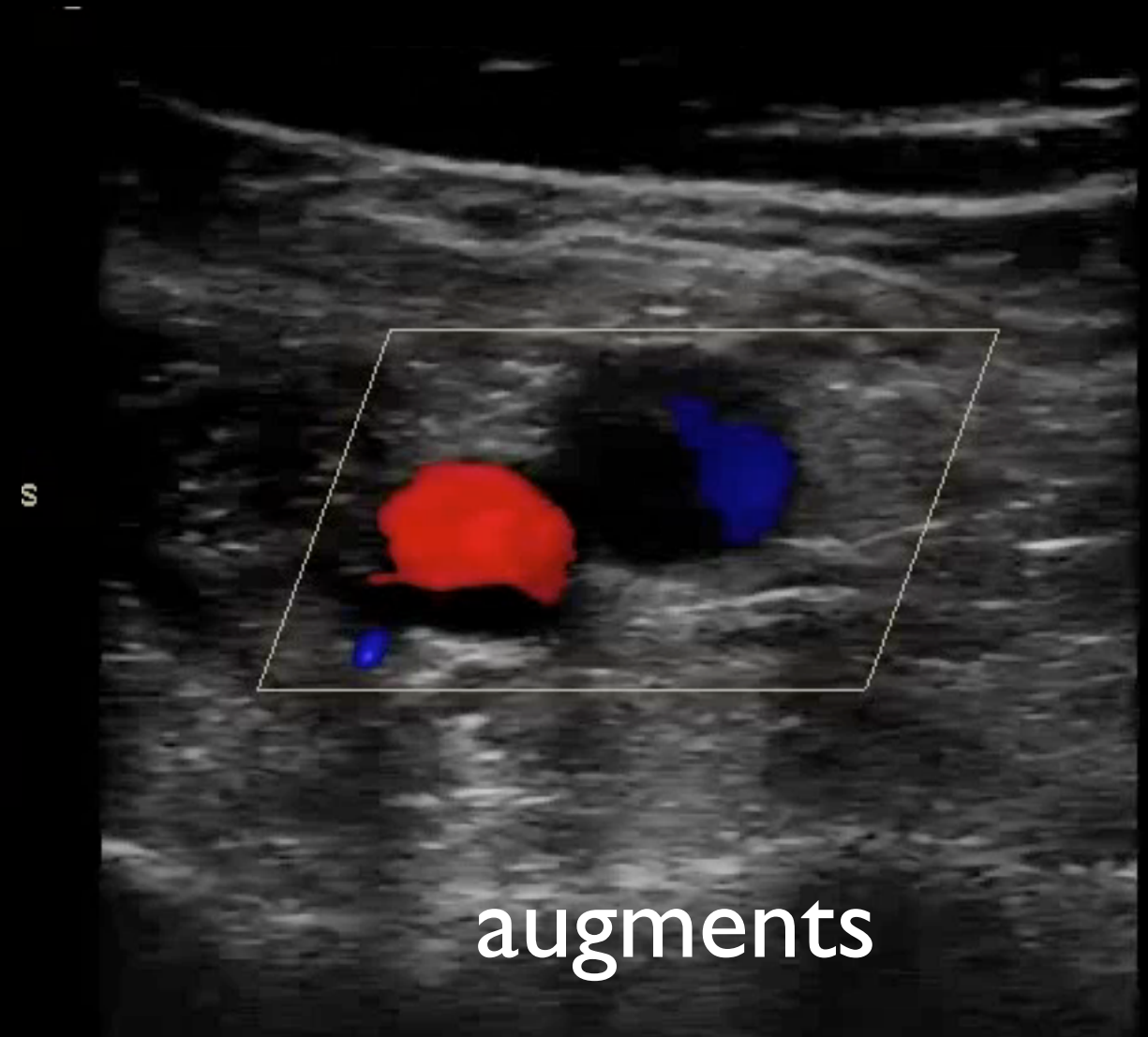
Cases

Case #3



Cases

Case #3



No DVT

Case #3

- Pt started on oral antibiotics, advised to obtain follow up ultrasound in 5-7 days.
- Patient was low risk, but cellulitis must be differentiated from possible DVT.
- ED ultrasound provided accurate diagnosis and rapid disposition

Summary

- Bedside ultrasound is a rapid tool for DVT evaluation in the LOW RISK patient
- Compressibility is the most important finding