Retroperitoneal Ultrasound

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Introduction

Retroperitoneal Ultrasound

- Aorta Ultrasound
  - Aneurysm
  - Dissection
- Renal Ultrasound
  - Hydronephrosis
  - Bladder/renal masses
  - Bladder volume estimation

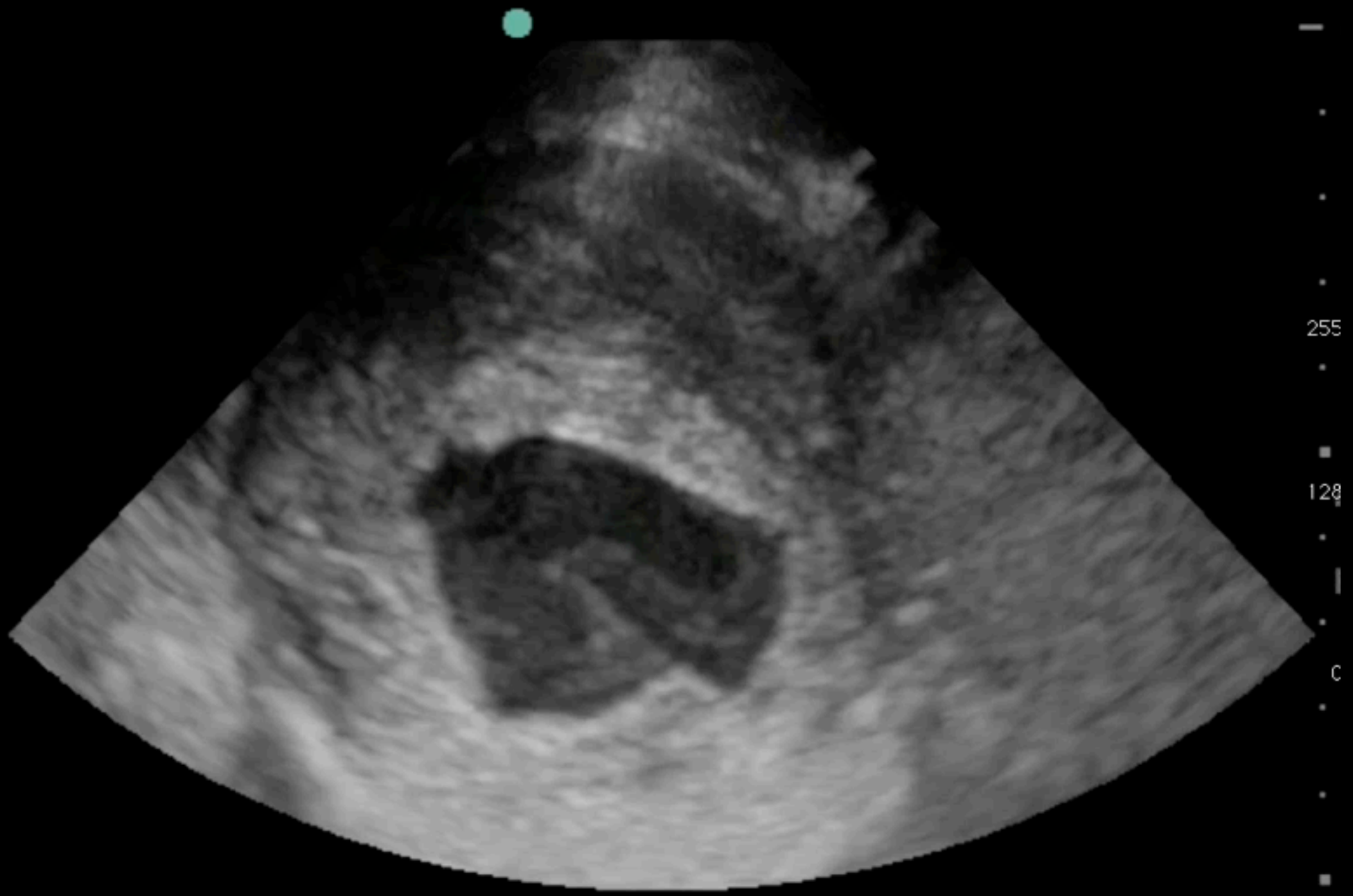
Abdominal Aortic Ultrasound

Dizziness, Syncope

- 67 yo male with dizziness, near syncope, 1 hour PTA while playing cards
- BP 80/30 P115 O2 95% T98
- Tachycardic and regular, lungs CTA, abd soft.

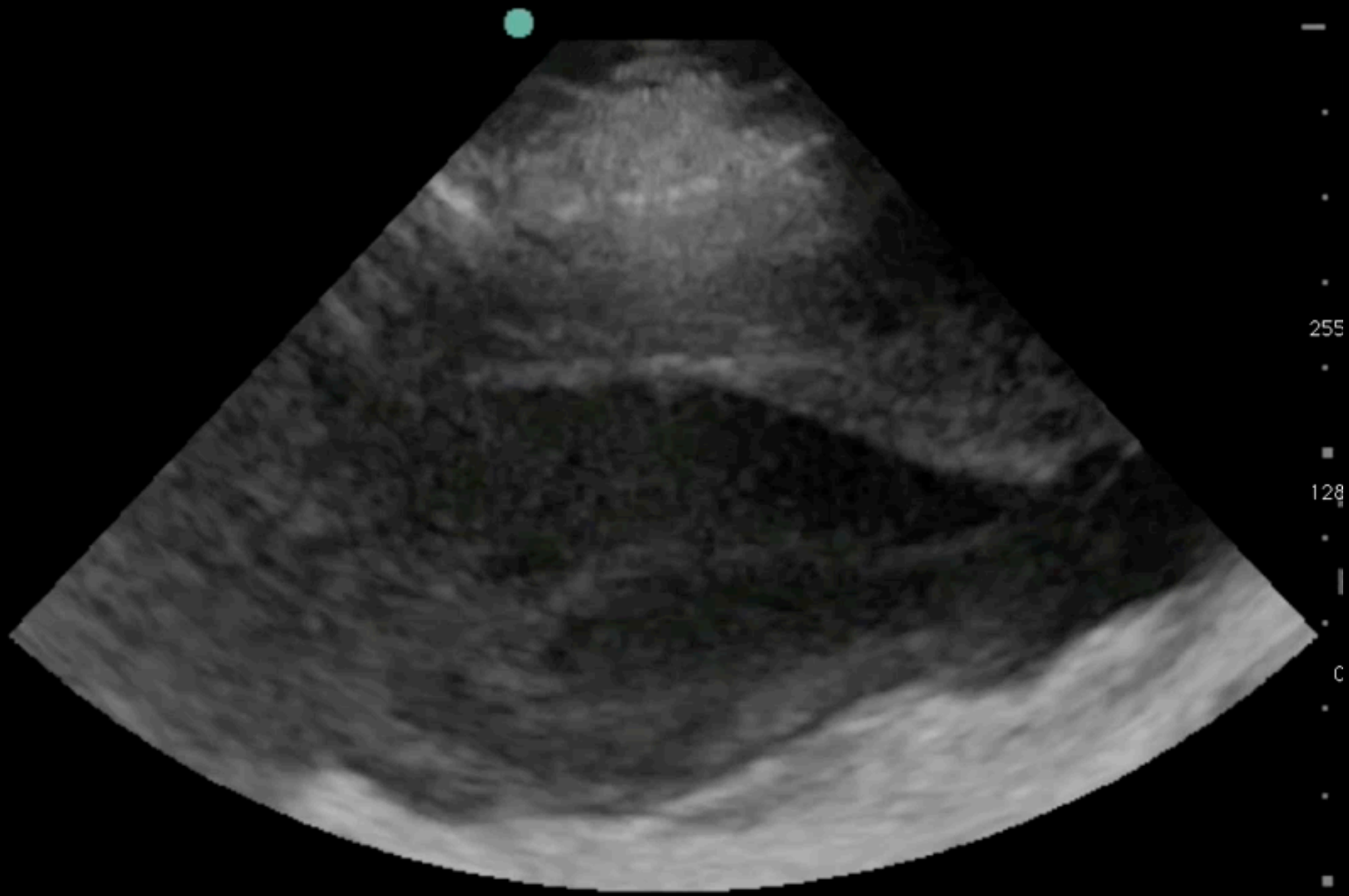
Case

Dizziness, Syncope



Case

Dizziness, Syncope



Case

Dizziness, Syncope

- Vascular surgery paged, pt to OR
- Large ruptured retroperitoneal aneurysm
- Successfully discharged 3 weeks later

Epidemiology

- 5% all elderly patients (over 65)
- Up to 10% in elderly male smokers (over 65)
- High mortality once rupture occurs
  - high incidence of renal failure in survivors
- Time to OR decreases mortality
- Elective repair--low morbidity/mortality

Introduction

AAA

- Abnormal: >3cm
  - <5cm: expands at ~2-4mm/year
  - >5cm: risk of rupture dramatically increased
- Asymptomatic until rupture

Presentation

- May present as:
  - renal colic
  - diverticulitis
  - GI bleed
  - MI
  - musculoskeletal pain
- "Classic Triad" (abdominal pain, back pain, palpable mass) not usually present

Screening

- Screening ultrasound for patients over 65 with:
  - abdominal pain
  - back pain
  - groin pain
  - hypotension
  - syncope
  - cardiac arrest

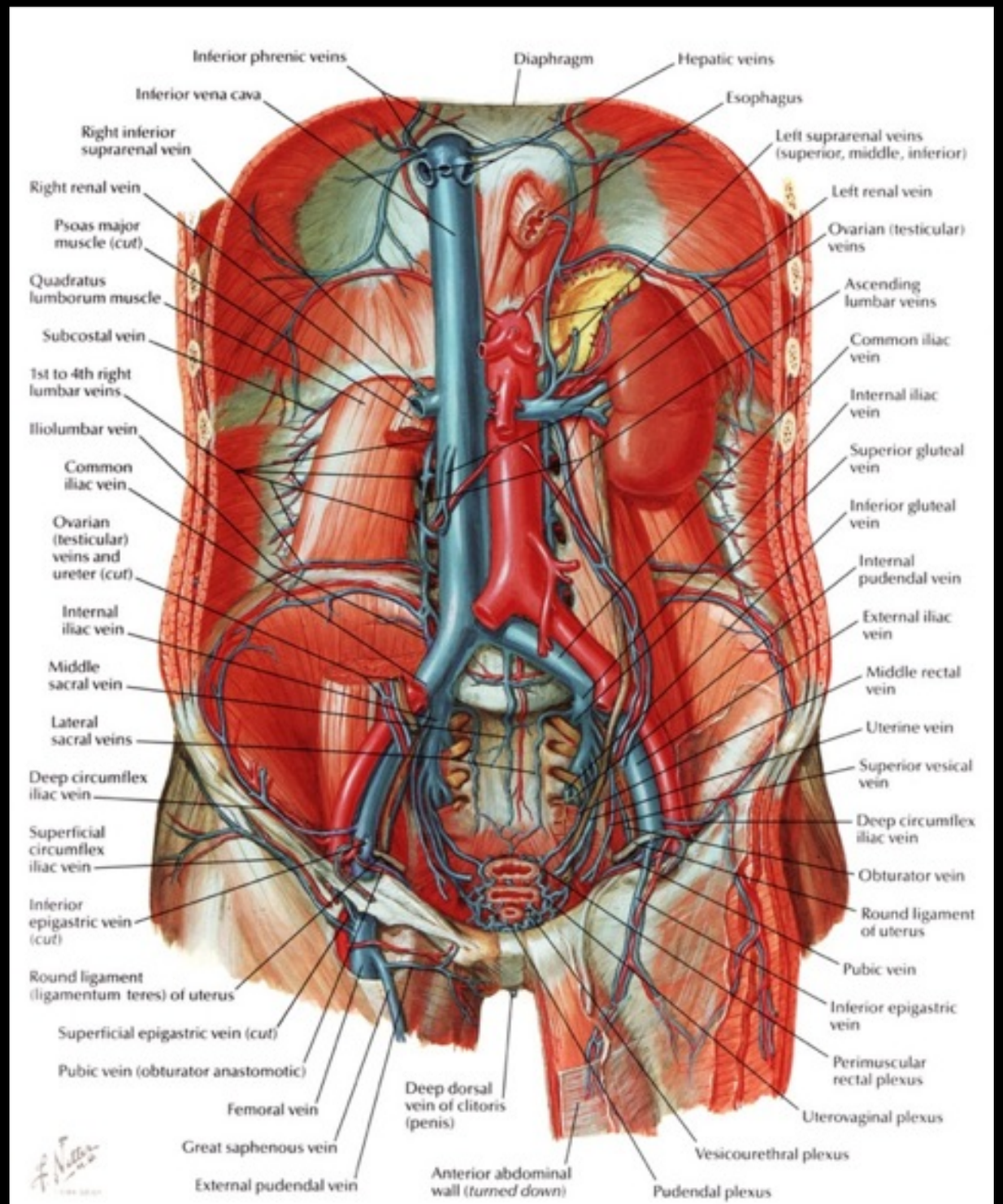
Ultrasound Detection

- Disease process:
  - may be difficult to detect
  - high mortality if missed
  - low mortality if detected early
- ED screening ultrasound:
  - rapid, easy
  - no need for transport
  - safe

Technical Considerations

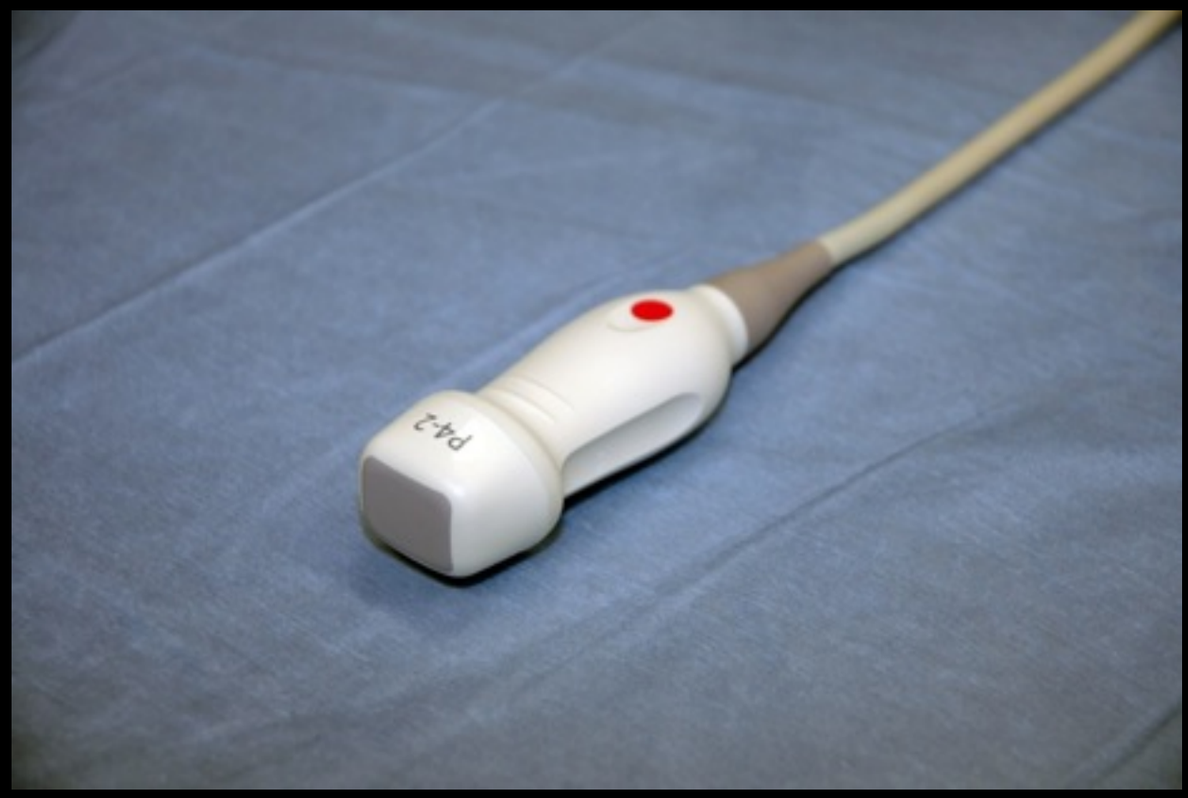
Technical Considerations

Abdominal Vascular Anatomy



Technical Considerations

Probes



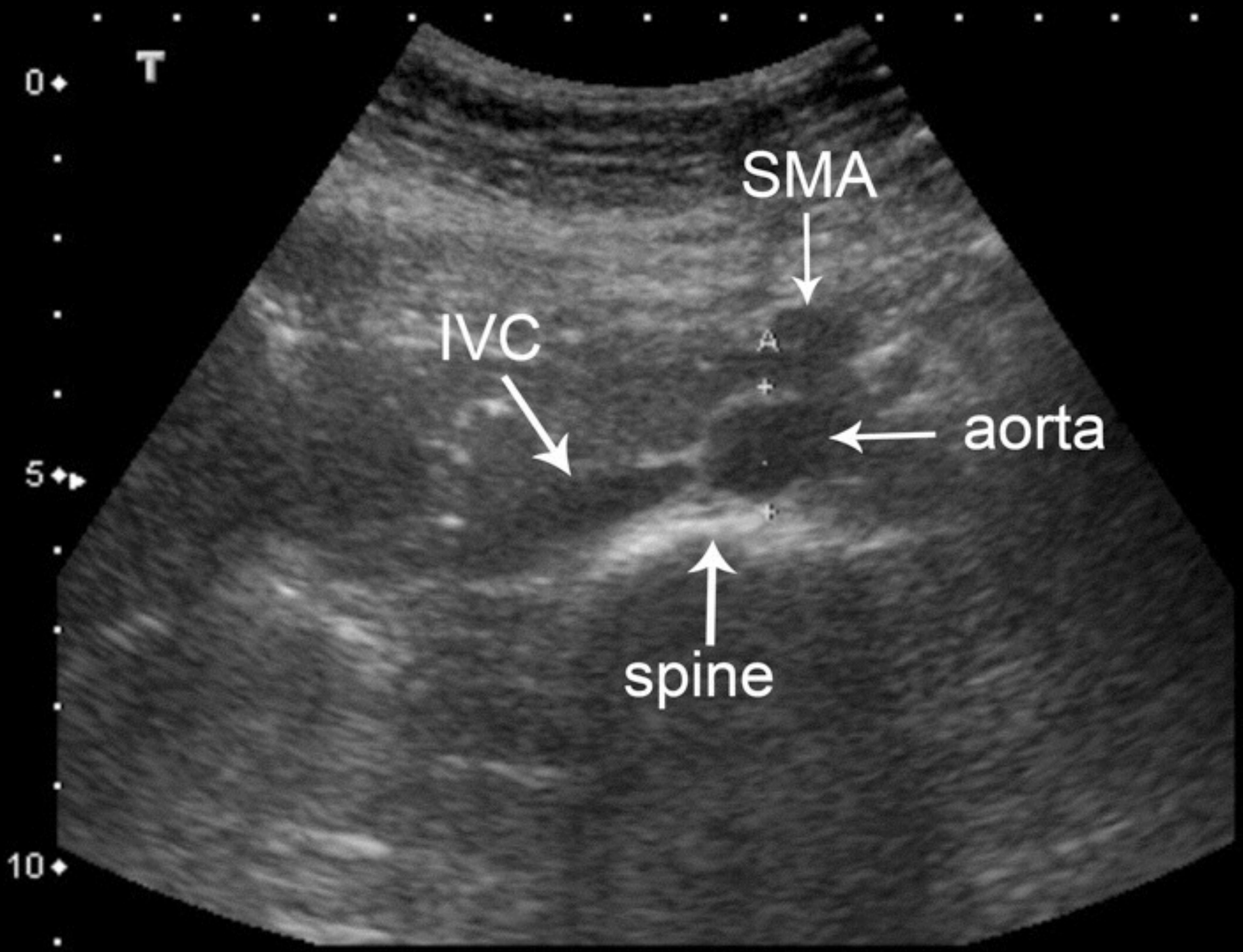
Normal Sonographic Findings

Normal Sonographic Findings

Transverse Proximal AA

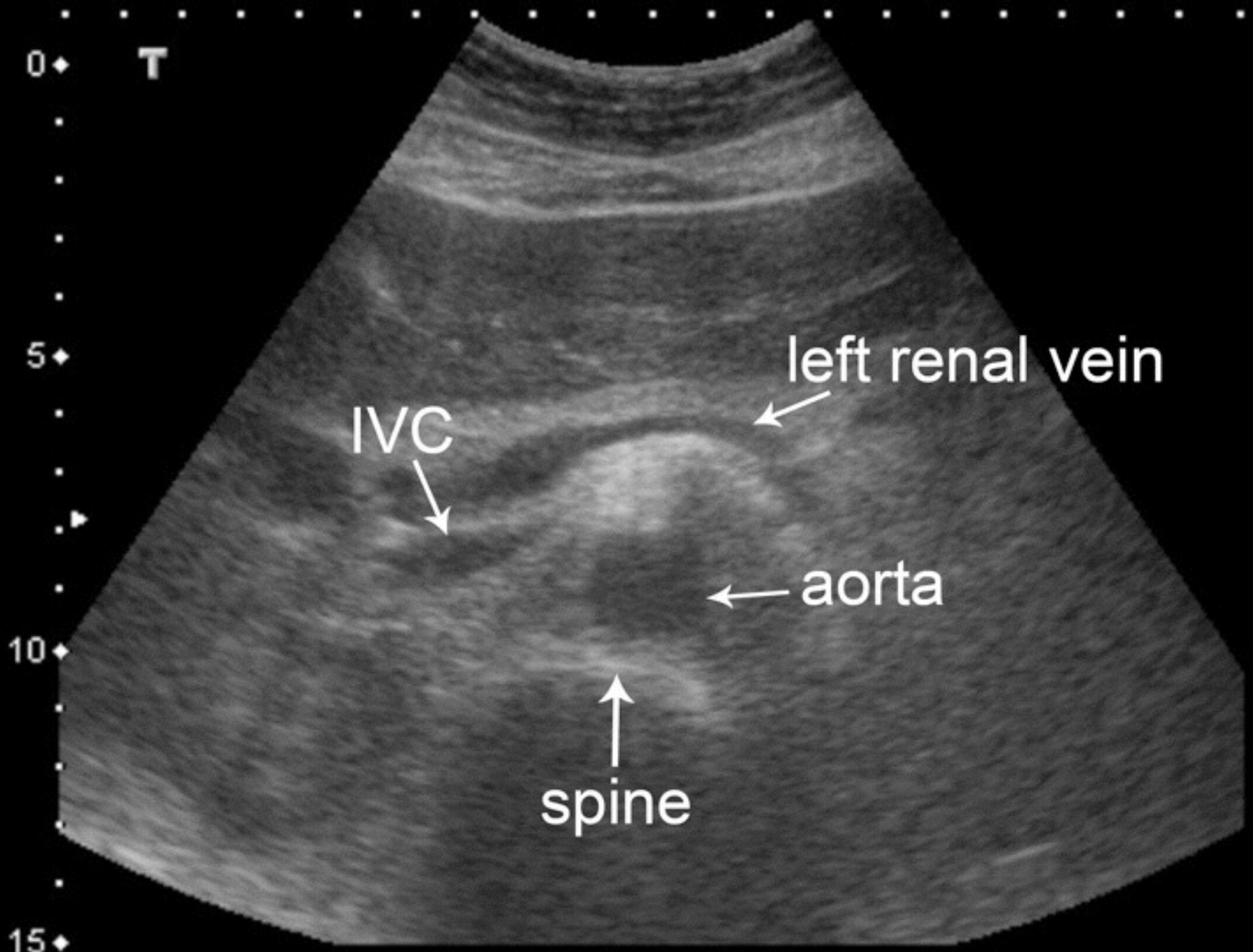
Normal Sonographic Findings

Transverse Proximal Aorta



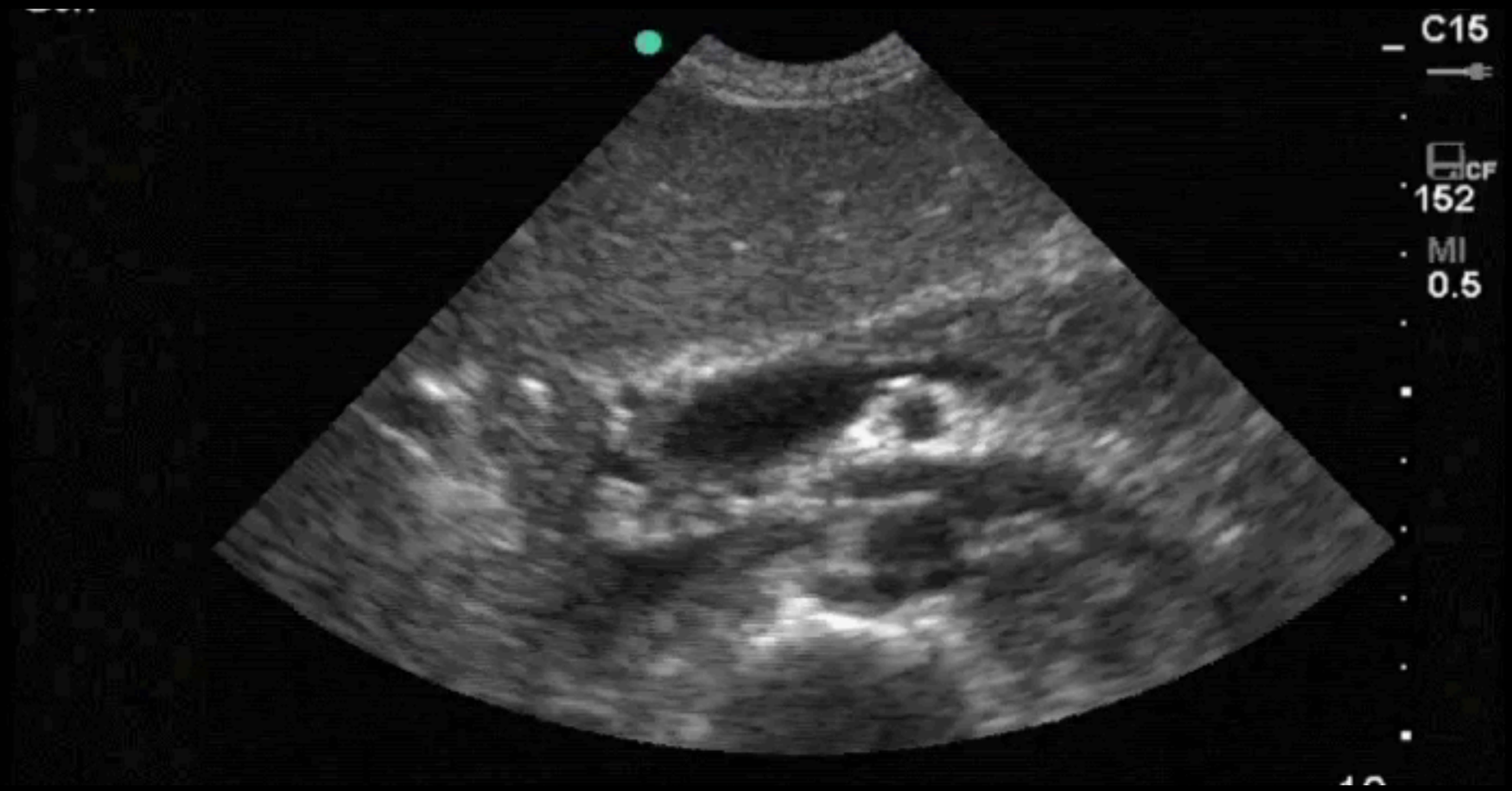
Normal Sonographic Findings

Transverse Proximal AA



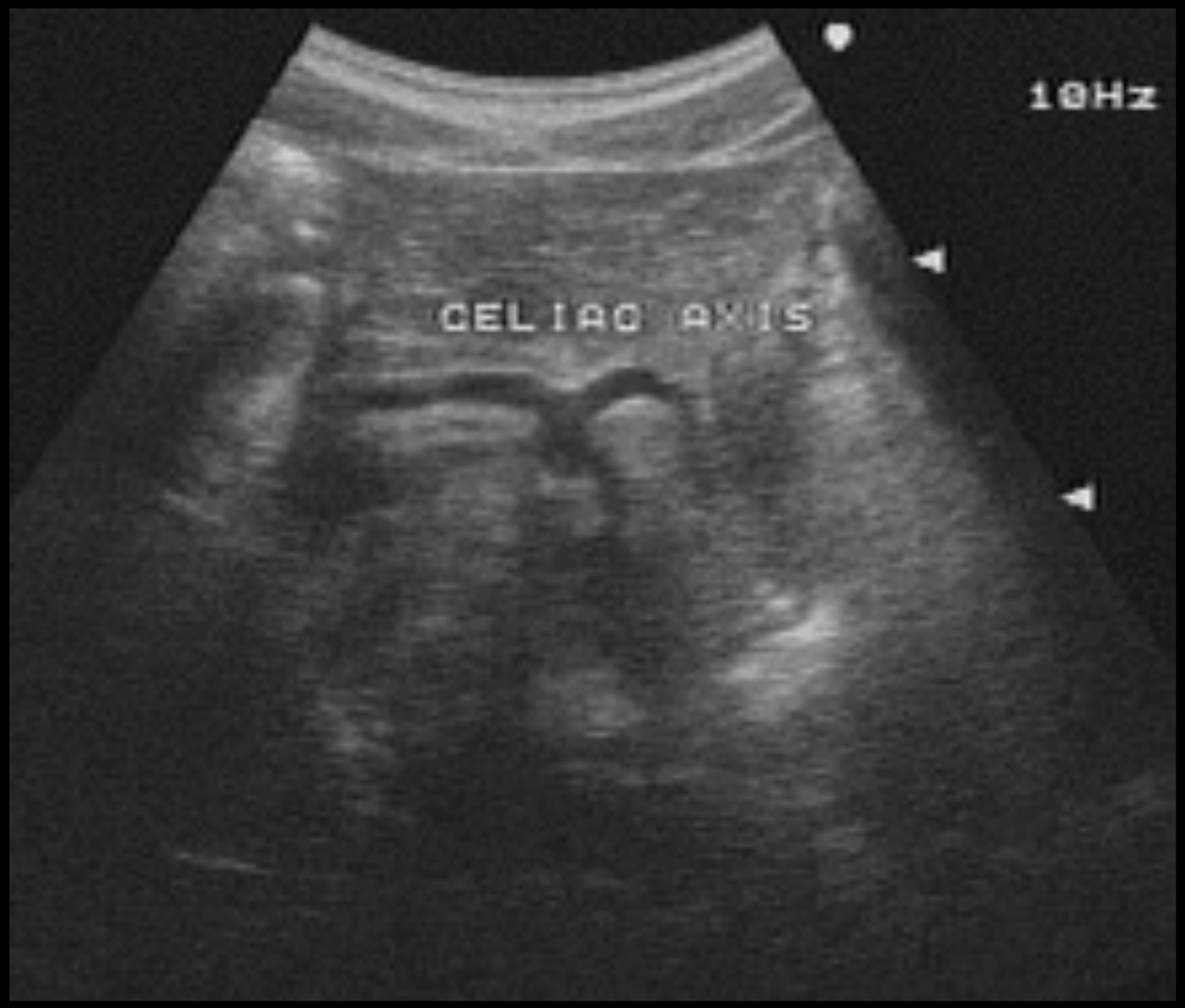
Normal Sonographic Findings

Transverse Proximal AA



Normal Sonographic Findings

Transverse Proximal AA



Normal Sonographic Findings

Longitudinal Proximal AA

Normal Sonographic Findings

Longitudinal Proximal AA

Normal Sonographic Findings

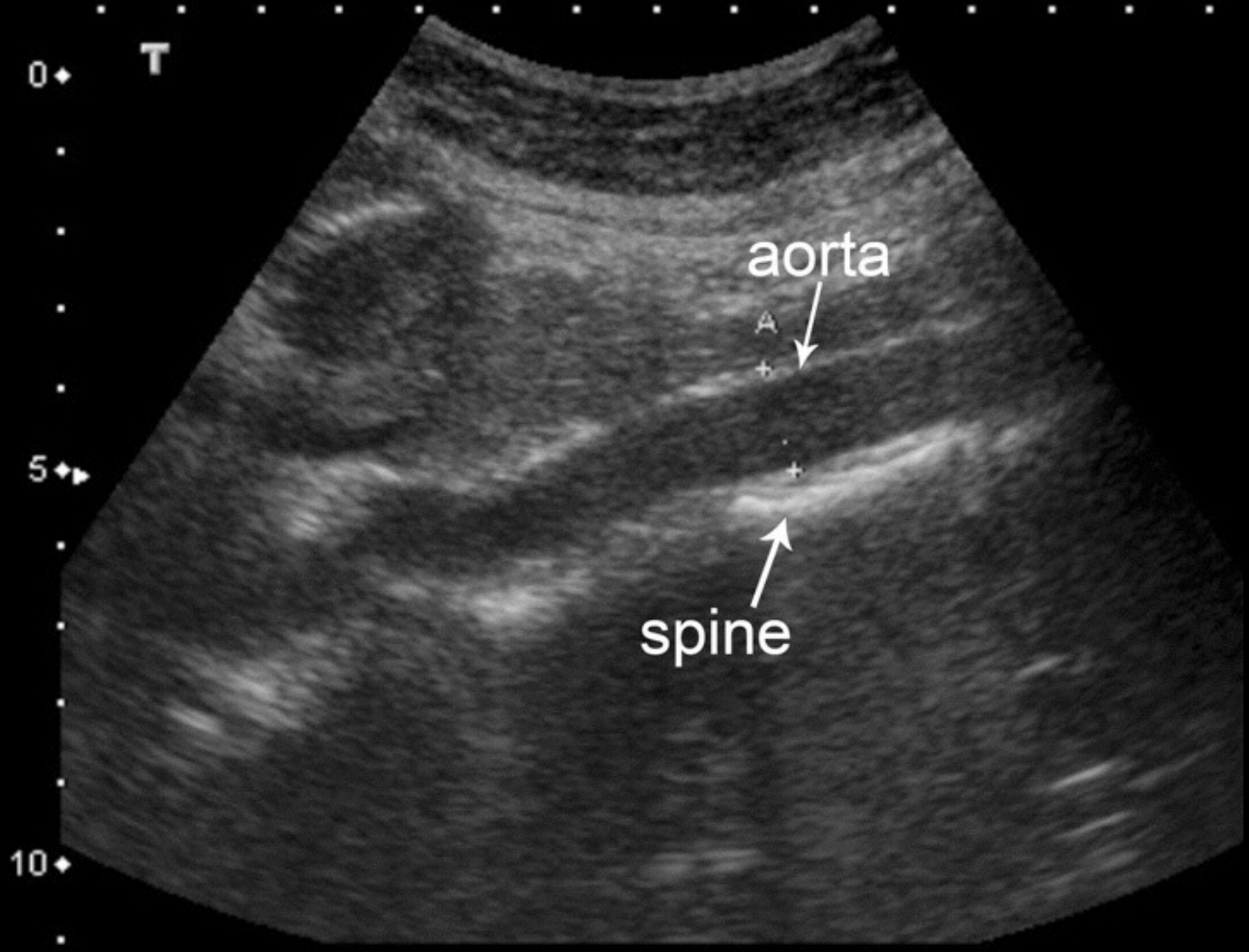
Longitudinal Proximal AA

Normal Sonographic Findings

Longitudinal Distal AA

Normal Sonographic Findings

Longitudinal Distal AA

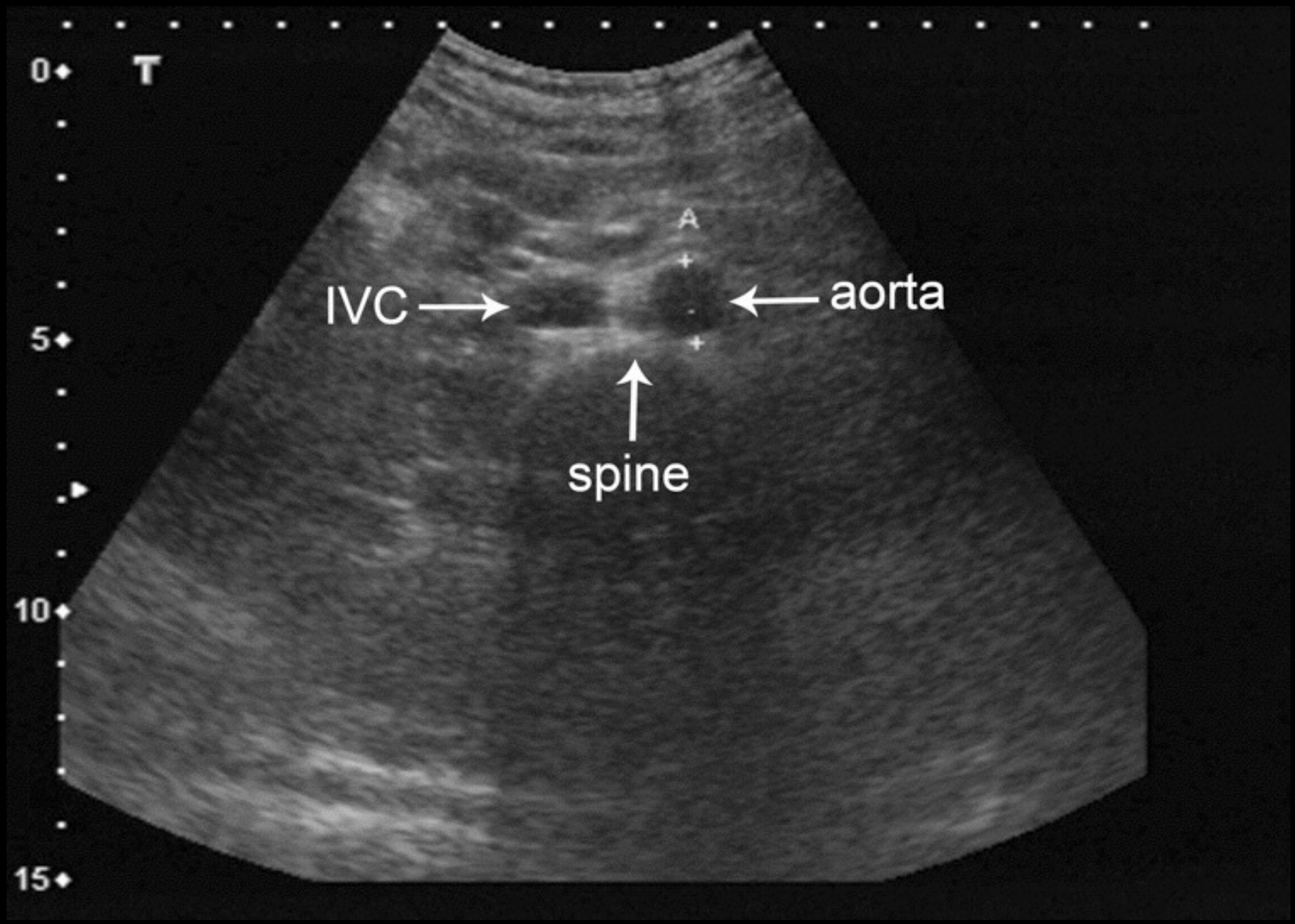


Normal Sonographic Findings

Transverse Distal AA

Normal Sonographic Findings

Transverse Distal AA



Normal Sonographic Findings

Transverse Distal AA

Normal Sonographic Findings

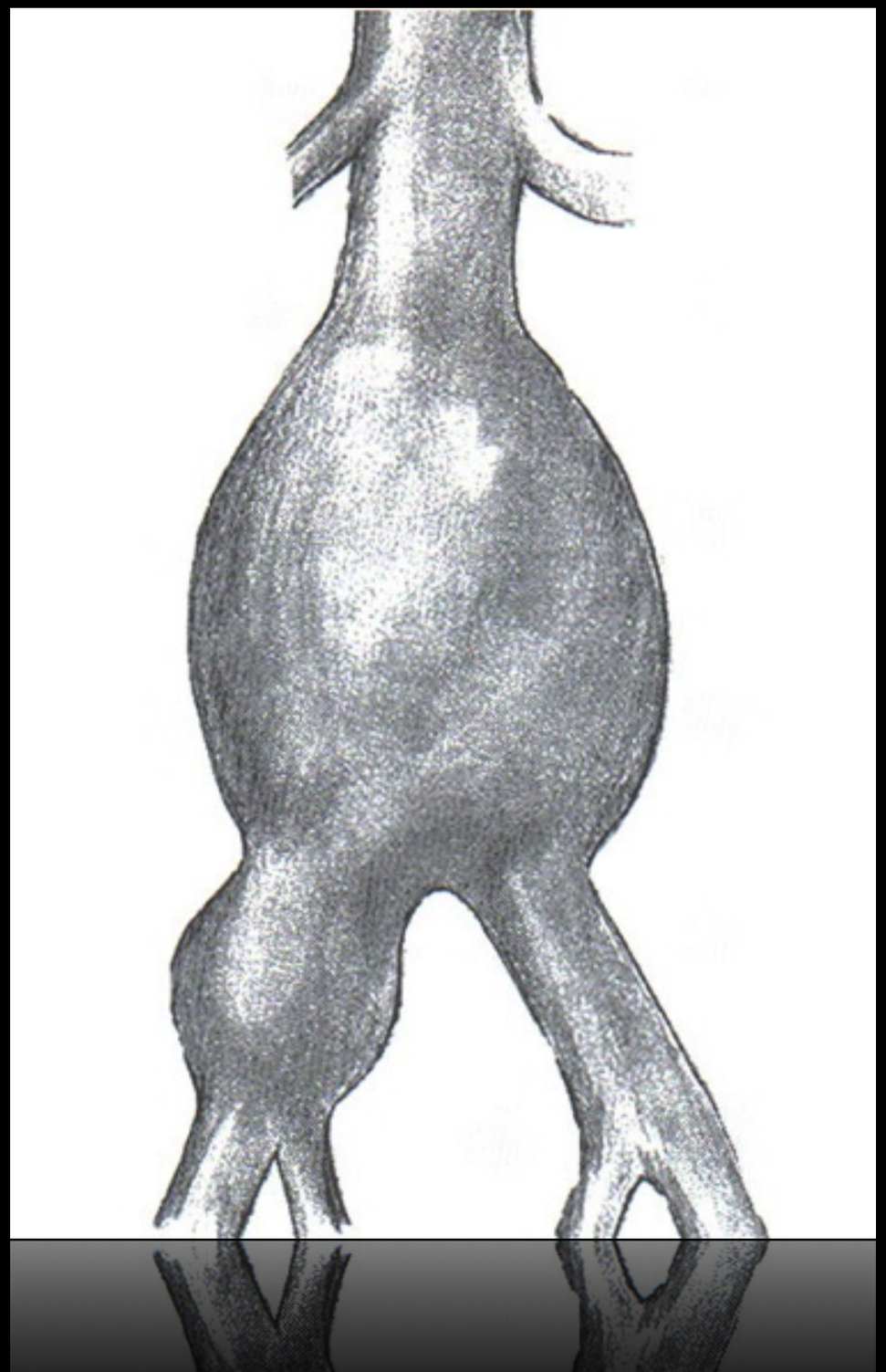
Transverse Distal AA

attempt to visualize bifurcation

Pathologic Sonographic Findings

Pathologic Sonographic Findings

Fusiform Aneurysms

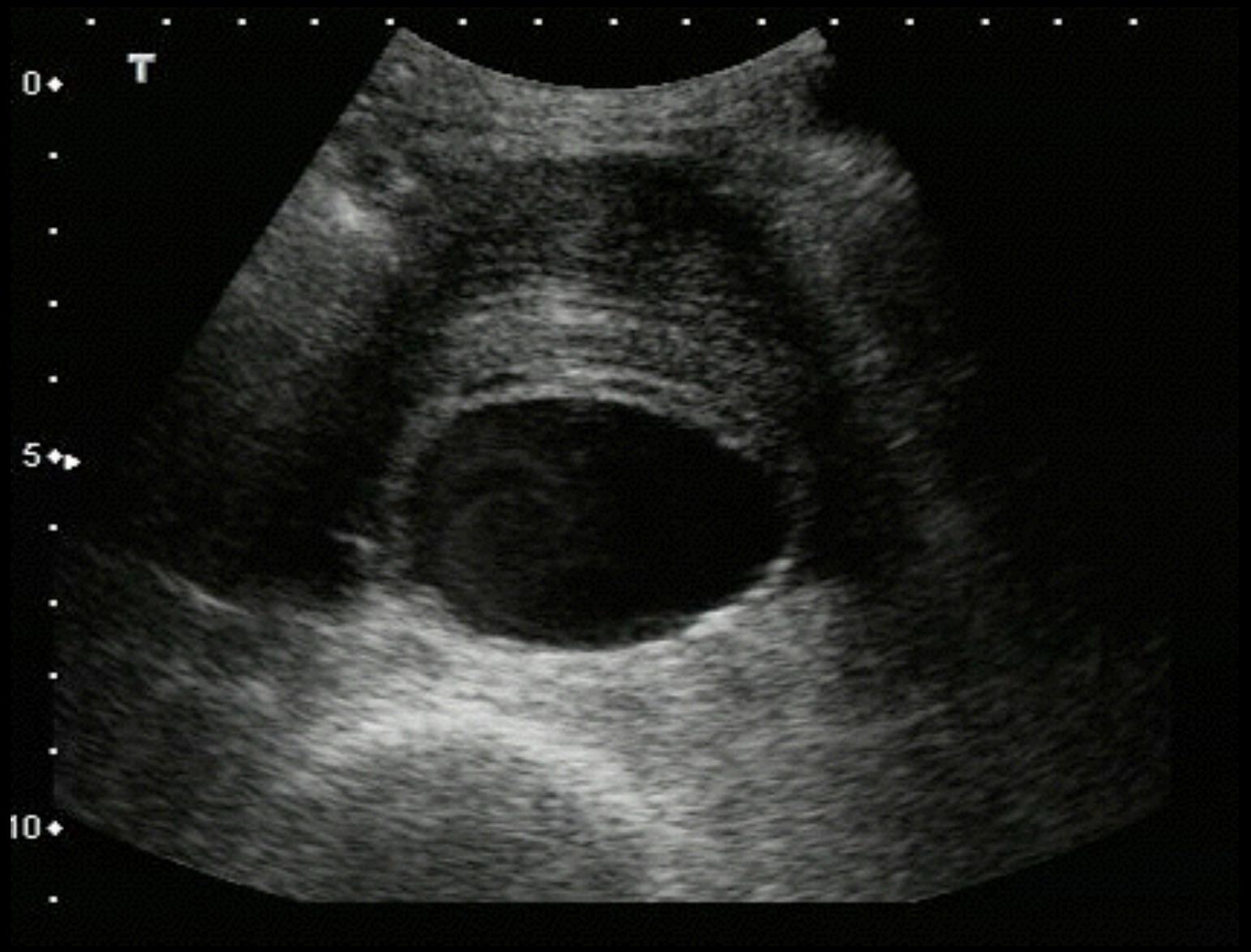


Pathologic Sonographic Findings

AAA

Pathologic Sonographic Findings

AAA



Pathologic Sonographic Findings

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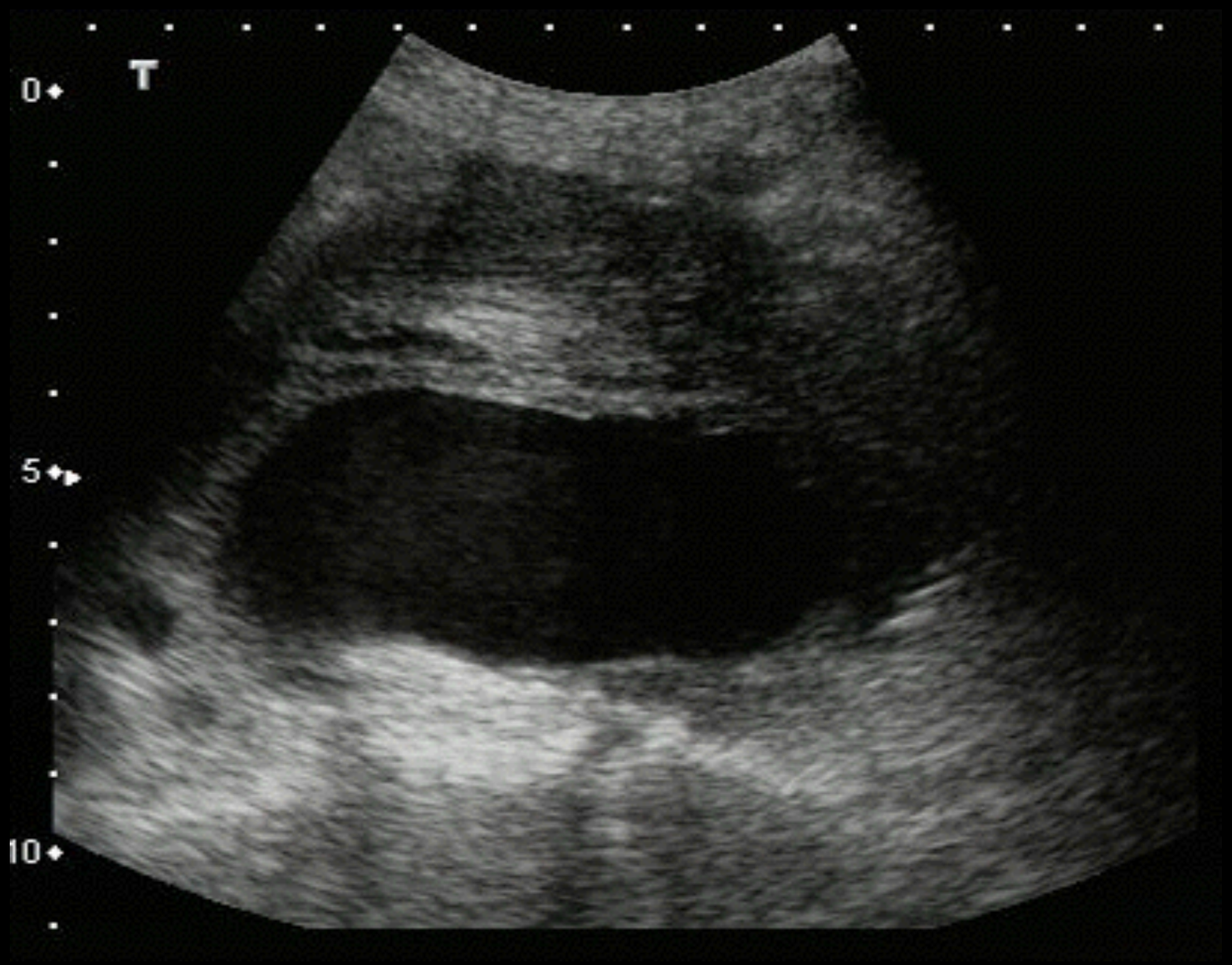

Pathologic Sonographic Findings

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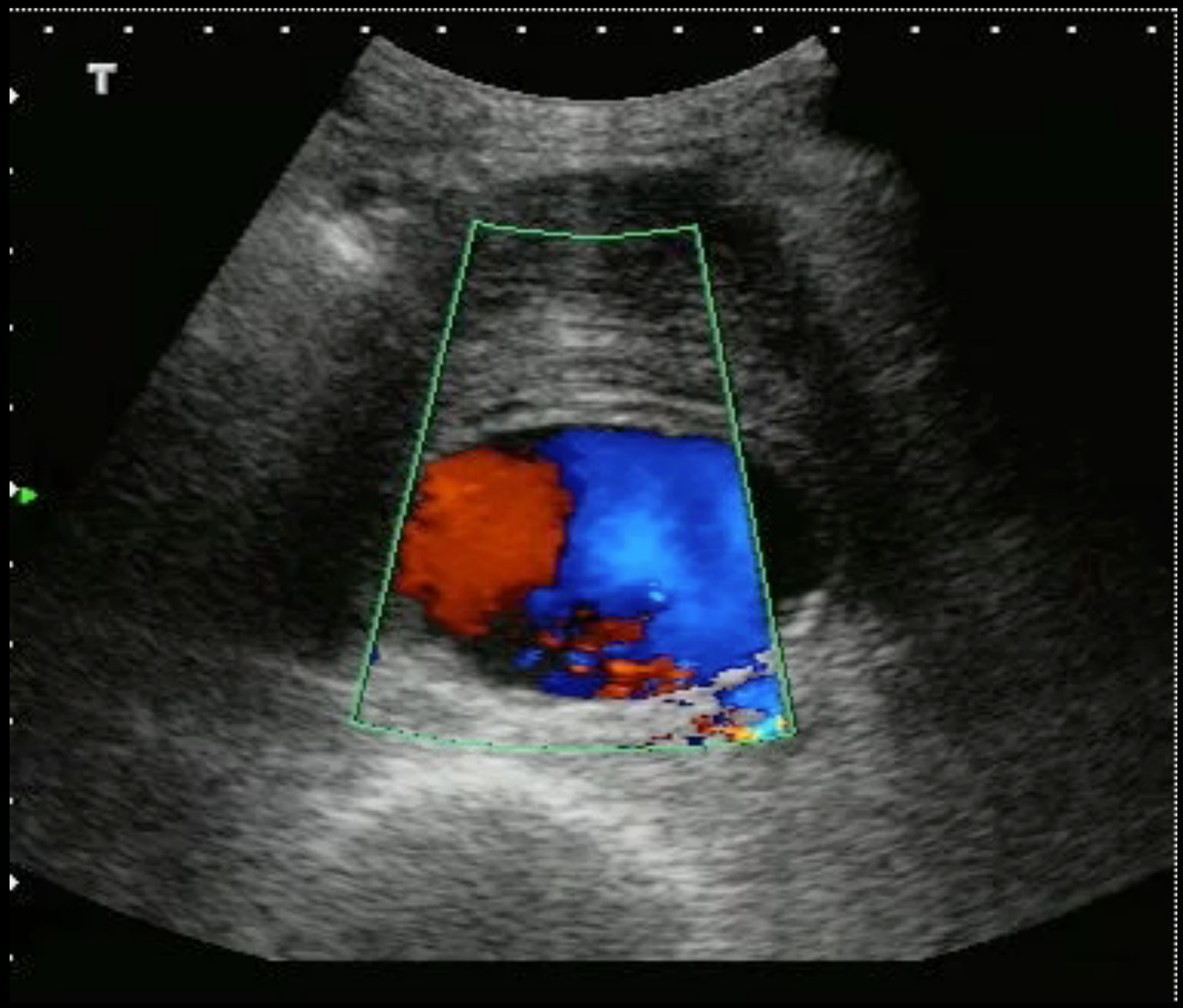
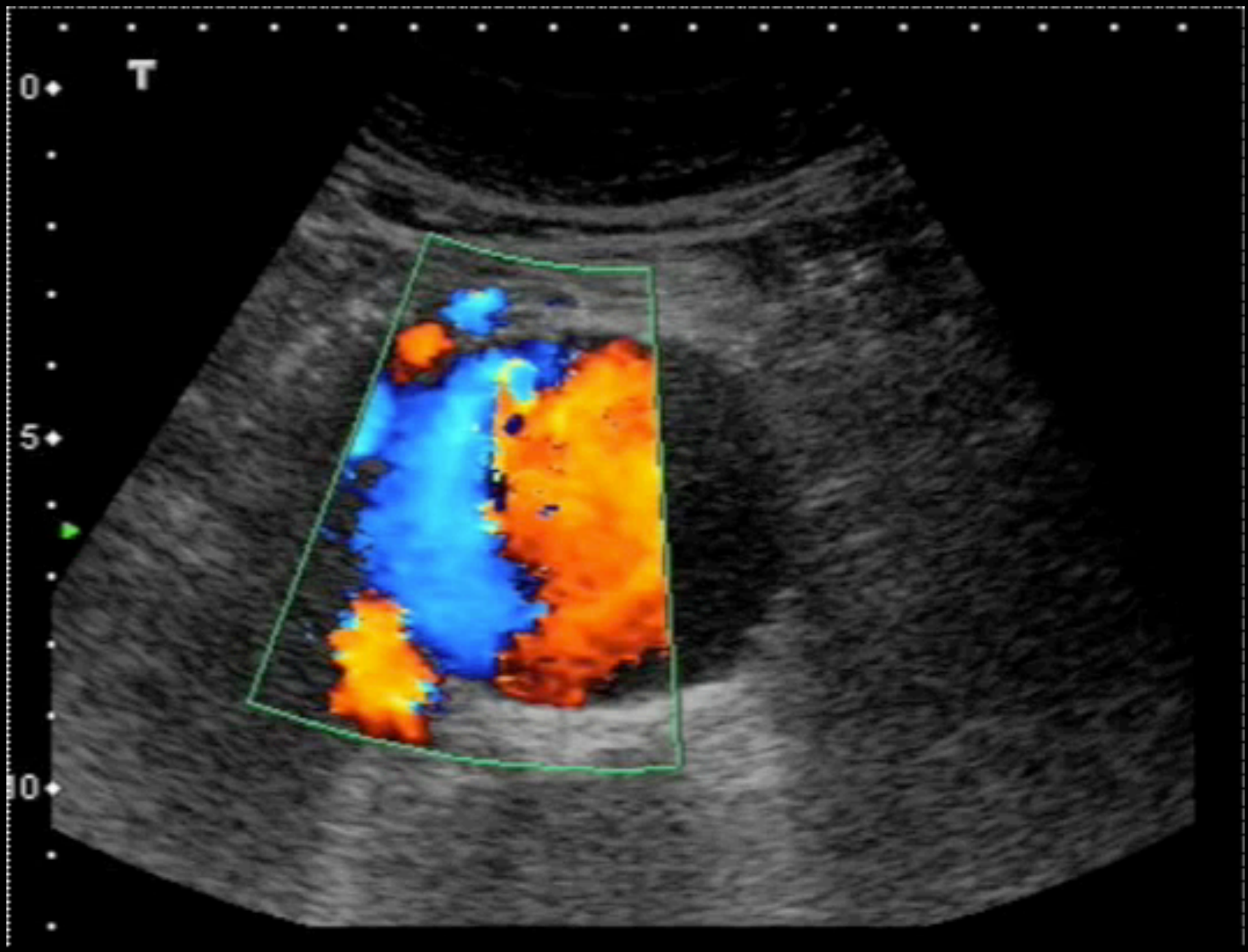


Pathologic Sonographic Findings

AAA

Pathologic Sonographic Findings

AAA

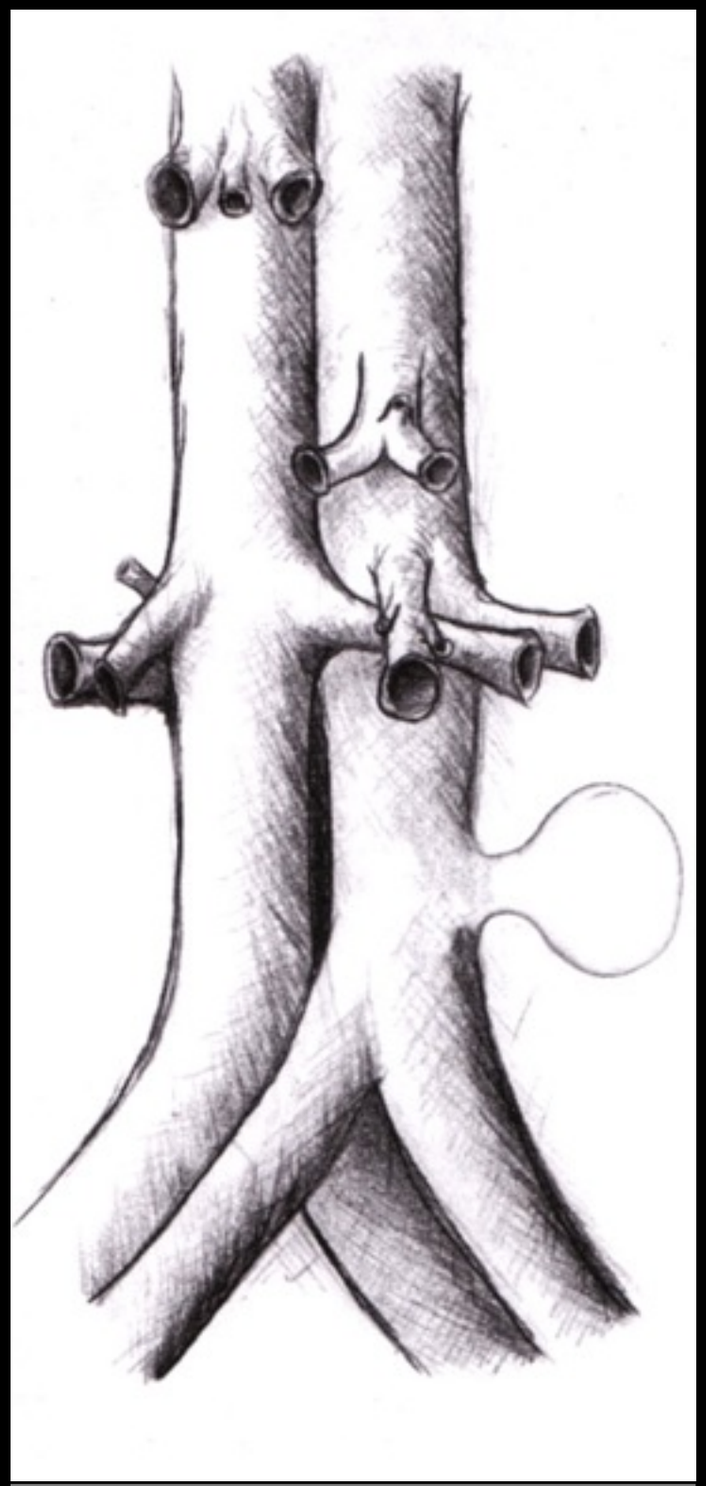


Pathologic Sonographic Findings

Iliac Aneurysm

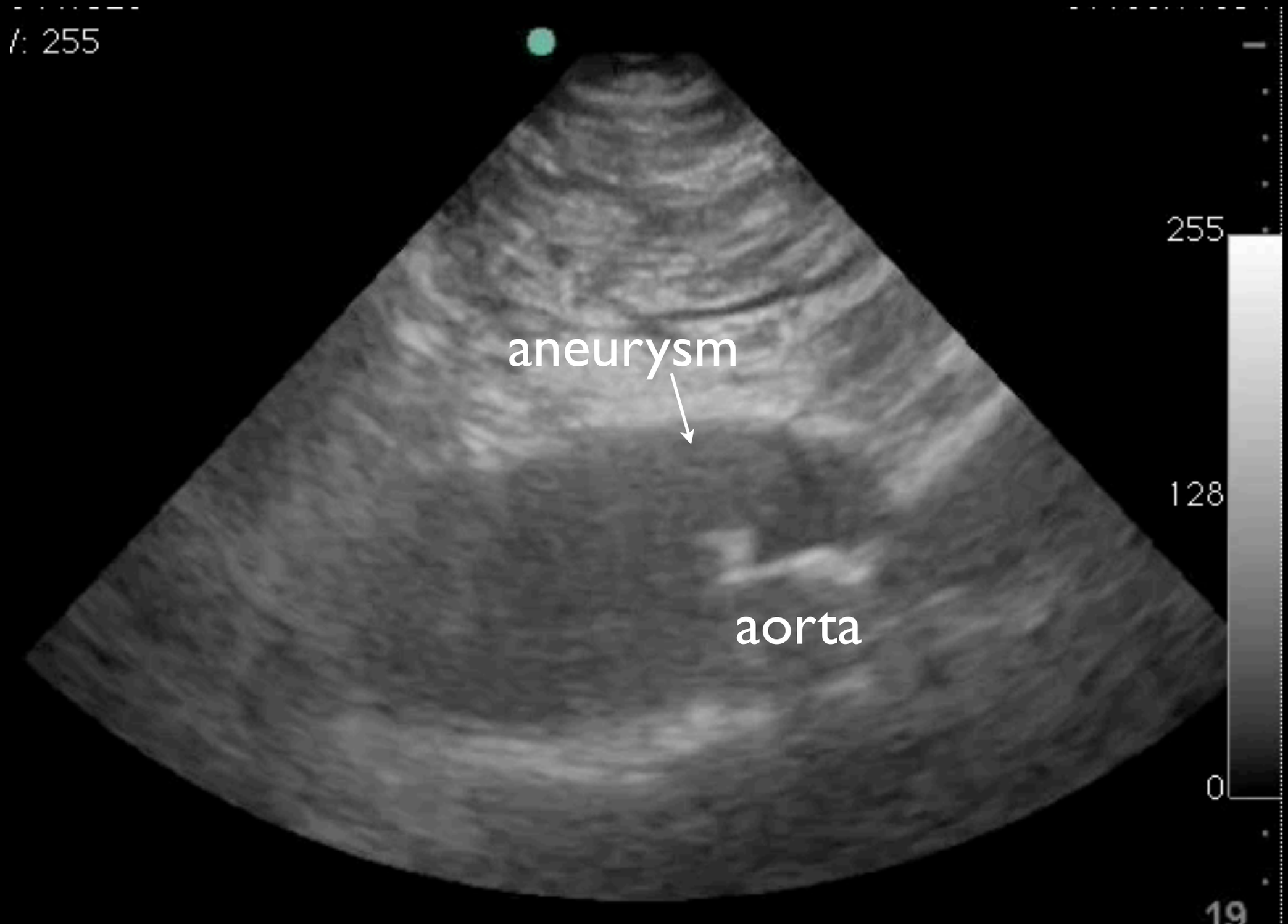
Pathologic Sonographic Findings

Saccular Aneurysms



Pathologic Sonographic Findings

AAA



Pathologic Sonographic Findings

AAA

Clinical care

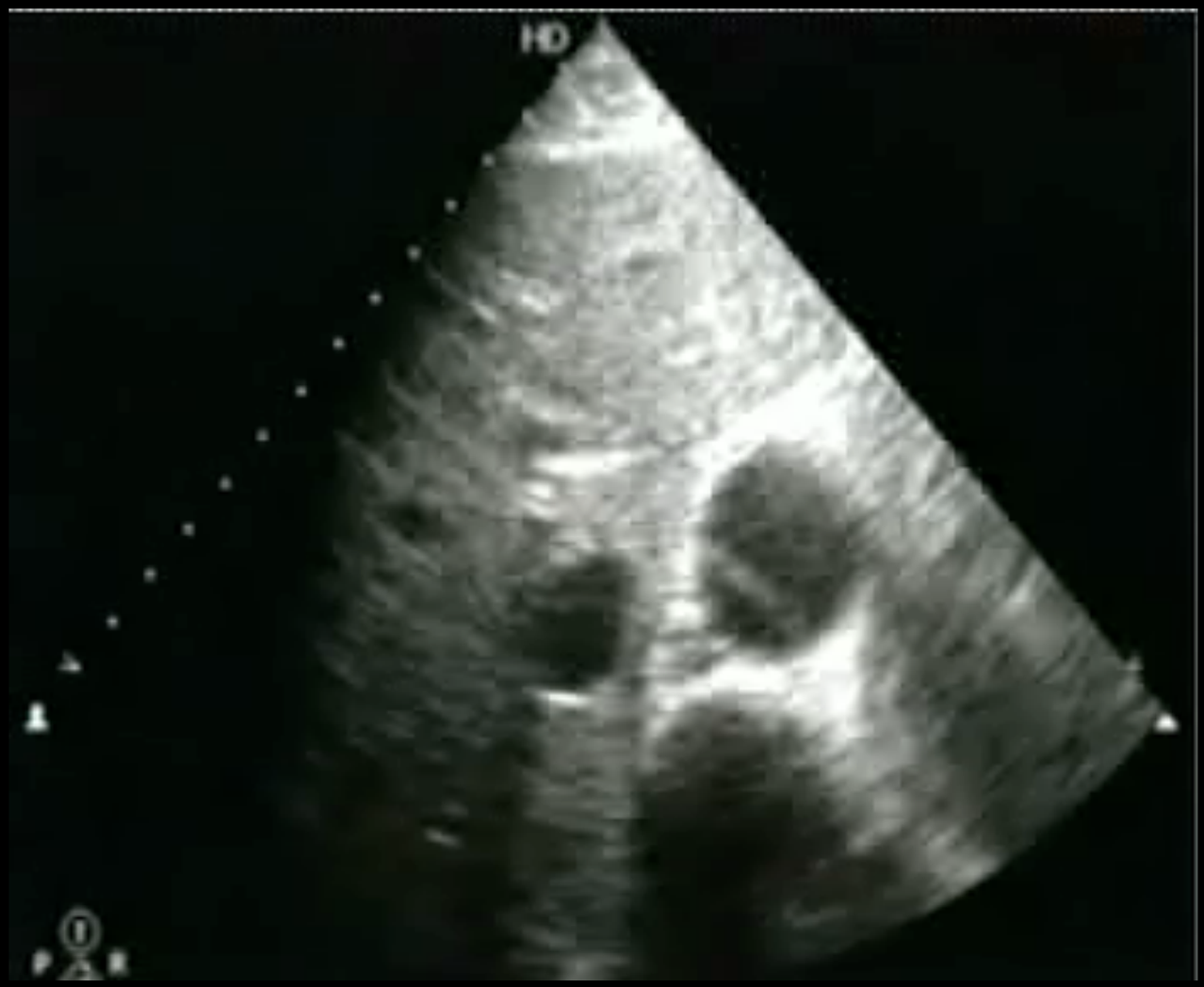
- AAA and suspected rupture
  - Obtain IV access and order blood
  - Look in RUQ for intraperitoneal blood
  - OR
- AAA and stable
  - 3cm: serial US/CT every 6 months
  - 4cm: outpatient surgical consult
  - 5cm: surgical consult in ED

Dissection

- CT more sensitive for aortic dissection
- However, dissection may occasionally be detected with ultrasound

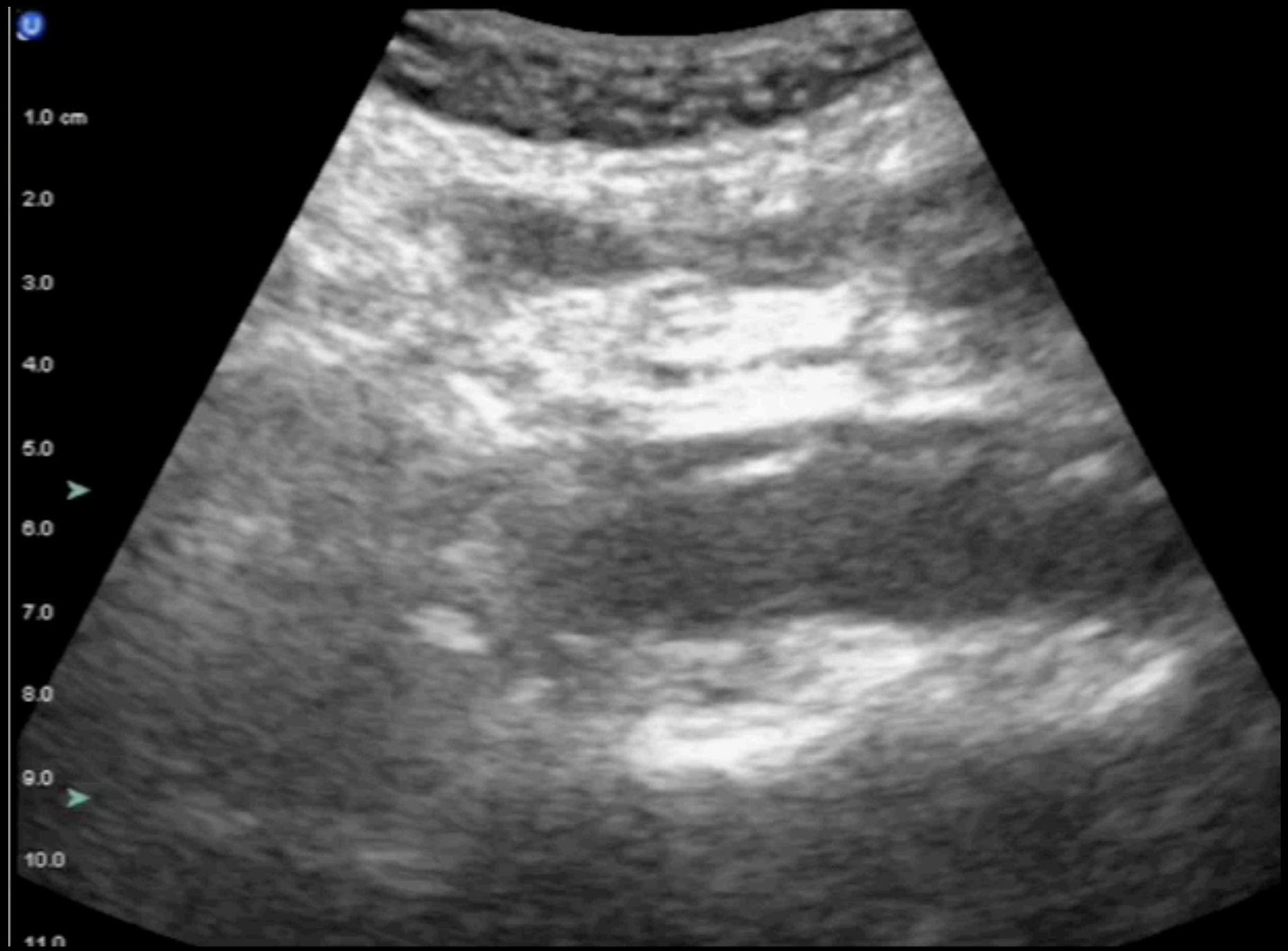
Pathologic Sonographic Findings

Aortic Dissection



Pathologic Sonographic Findings

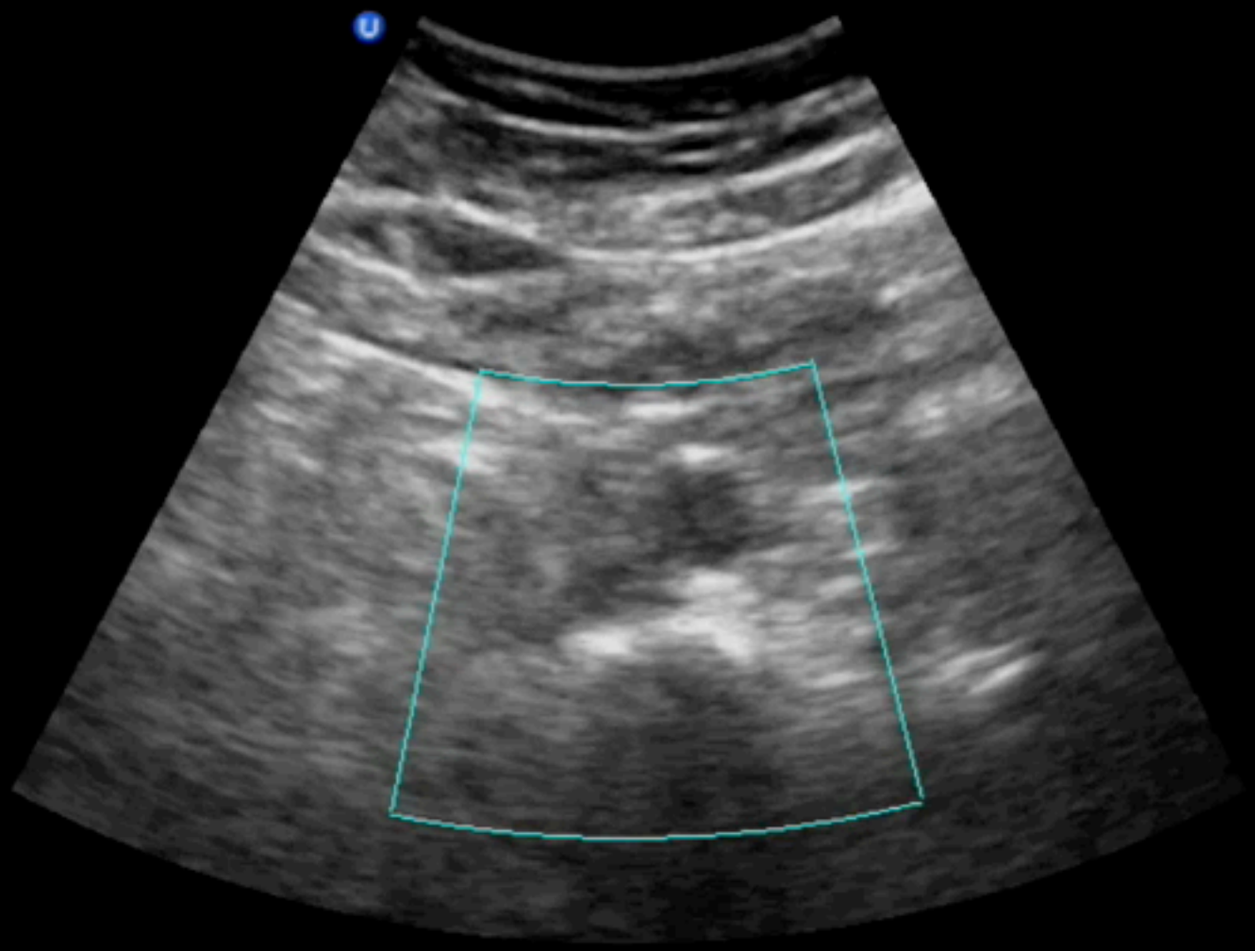
Aortic Dissection



Pitfalls

Pitfalls

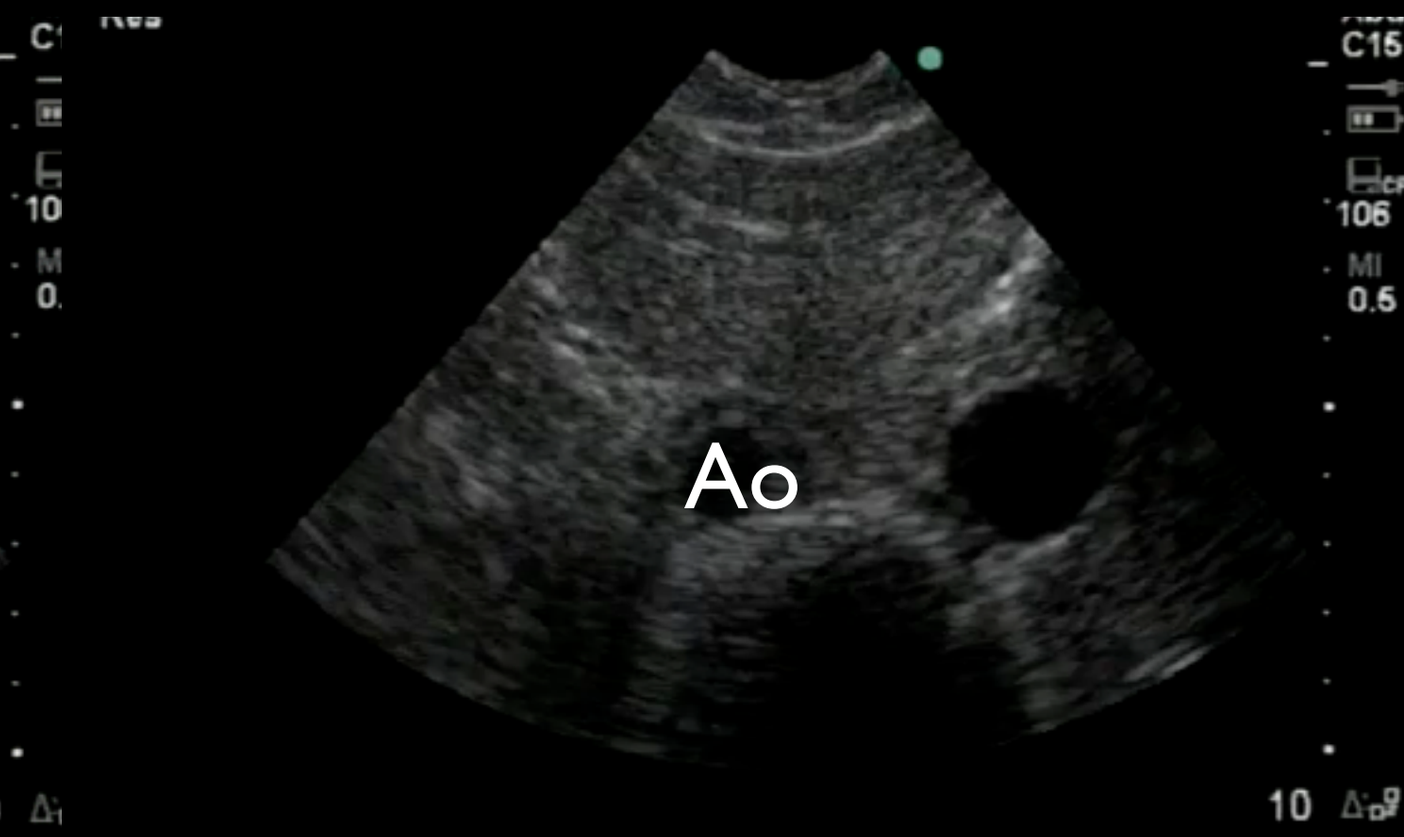
Color



Do not rely on color or pulsatility to differentiate aorta from IVC

Pitfalls

Probe Reversal

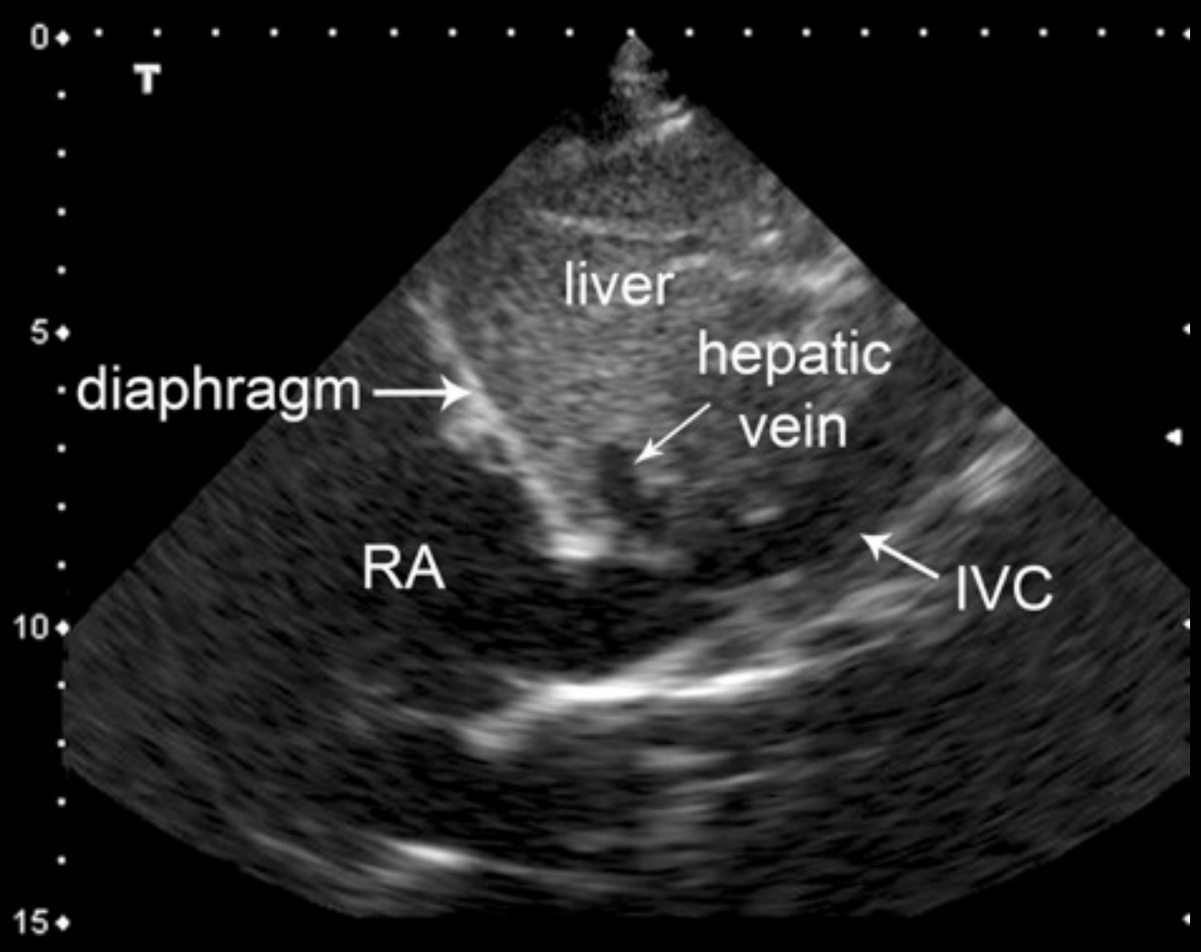


Pitfalls

Probe Reversal

Pitfalls

Aorta vs IVC

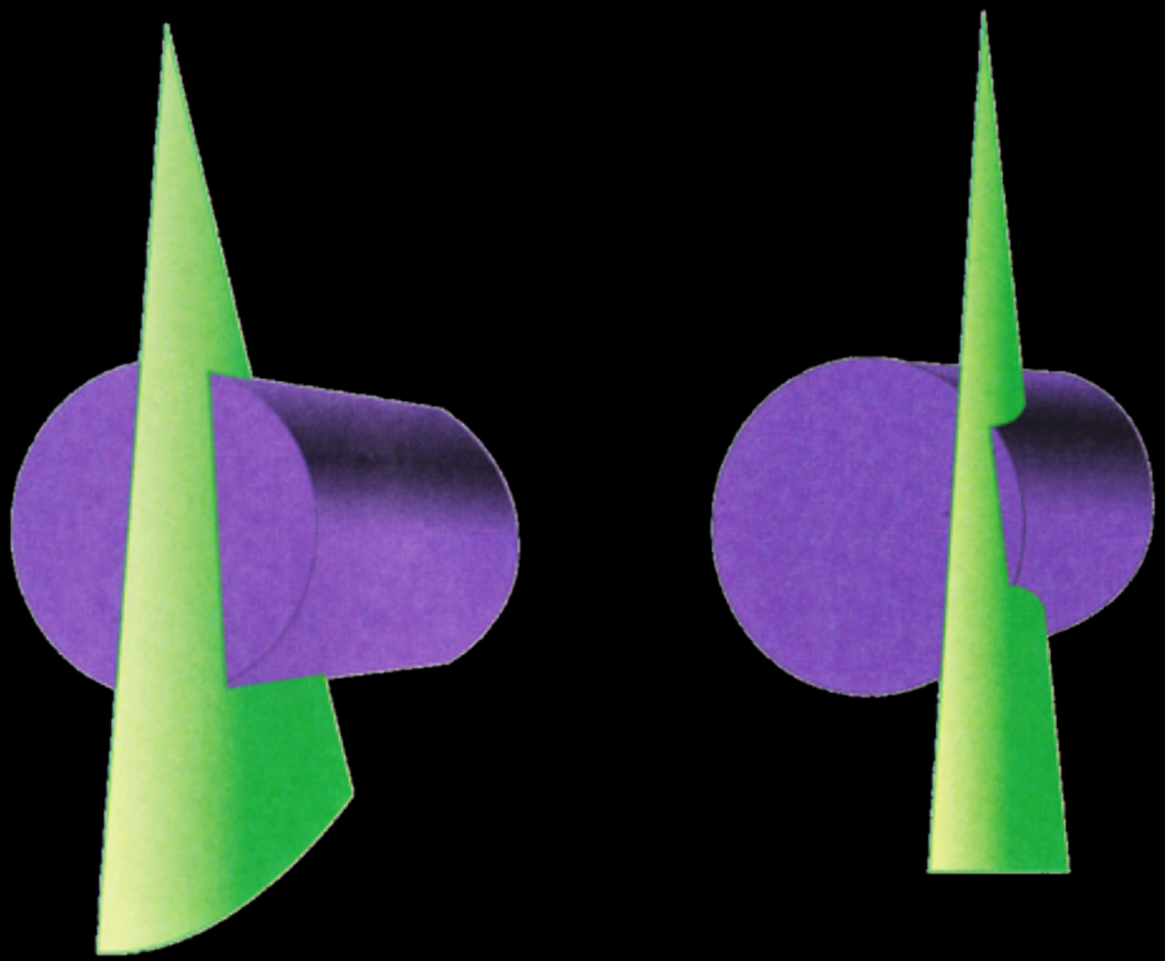


Pitfalls

Underestimation of Diameter

Pitfalls

Tangential Measurement



midline

off midline

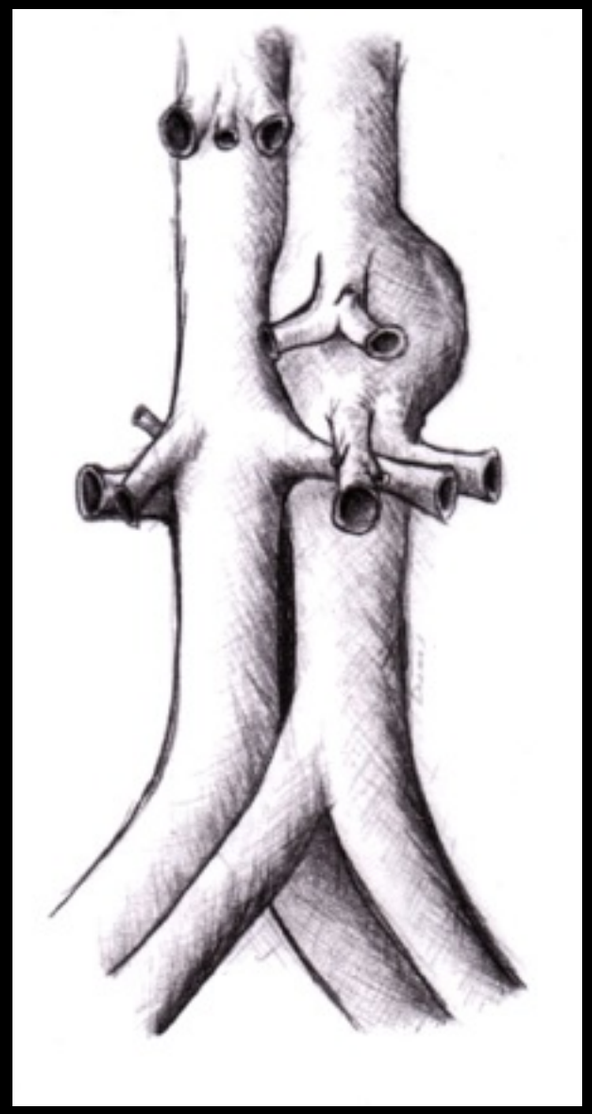
Cylinder Tangential Effect

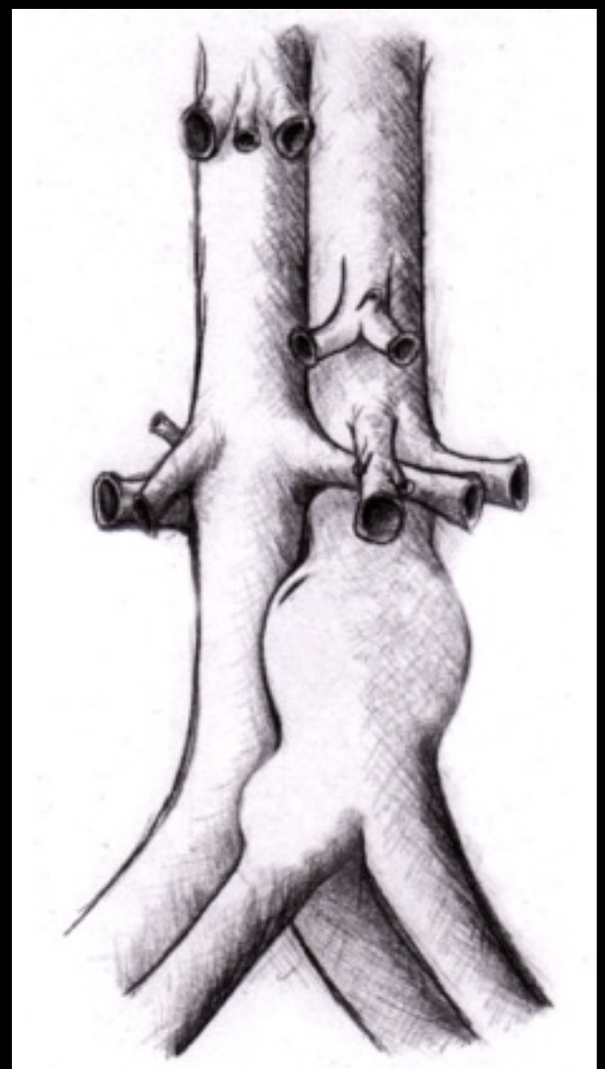
- measurement of aorta in longitudinal view underestimates diamter

Pitfalls

Distal AAA

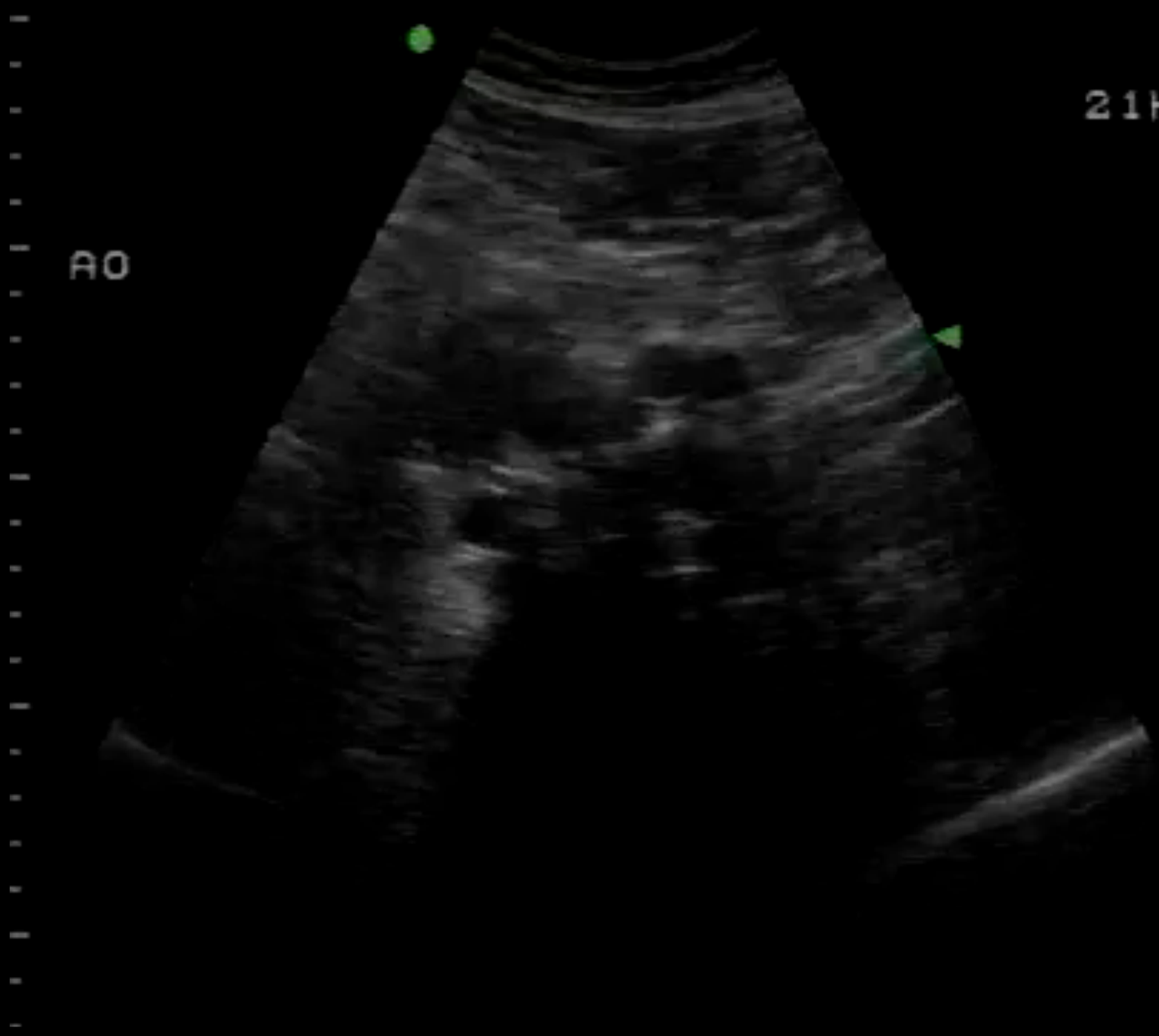
- Infrarenal: 90%
- 1/3 involve suprarenal and infrarenal aorta
- *Trace aorta down to bifurcation*





Pitfalls

Iliac Artery Aneurysms



Pitfalls

Spine as Aorta

Pitfalls

SMA as Aorta

Summary

- screening ultrasound of aorta is useful
- rapid, safe
- does not rule out dissection
- thoracic aorta more difficult to visualize

Emergency Renal Ultrasound

Objectives

- hydronephrosis
- bladder volume
- bladder/renal masses
- renal cysts

Intravenous Pyelogram

- more specific than ultrasound
- risk of allergy
- nephrotoxicity

Introduction

CT

- high sensitivity for renal calculi (86-100%)
- visualize other structures
- radiation exposure

Ultrasound

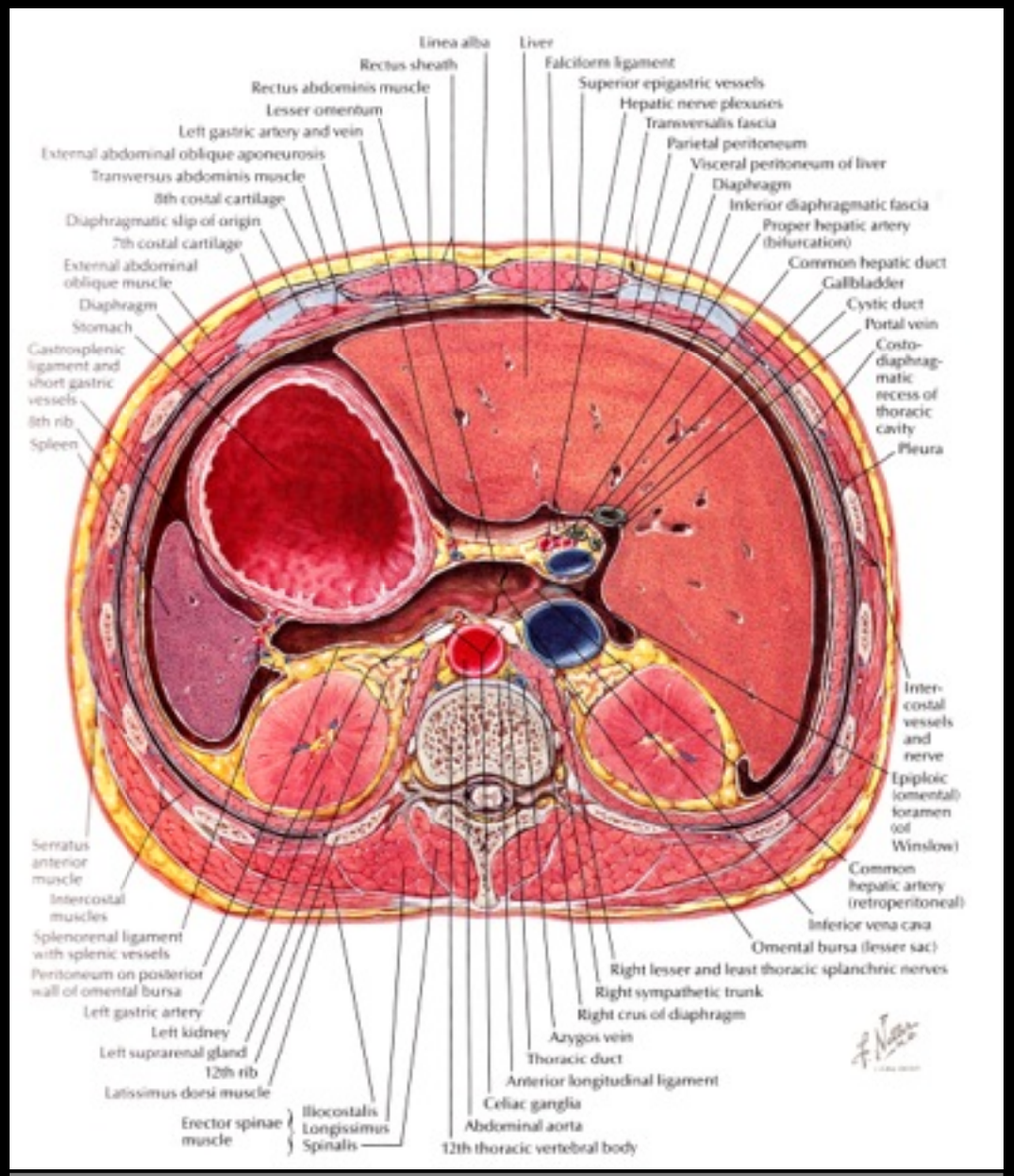
- performed safely and quickly at bedside
- sensitive for ureteral stone with:
  - flank pain
  - hematuria (64-97%)
- may help determine need for consultation
- combine with other exams
  - exclude AAA, ectopic pregnancy,

Technical Considerations

Technical Considerations

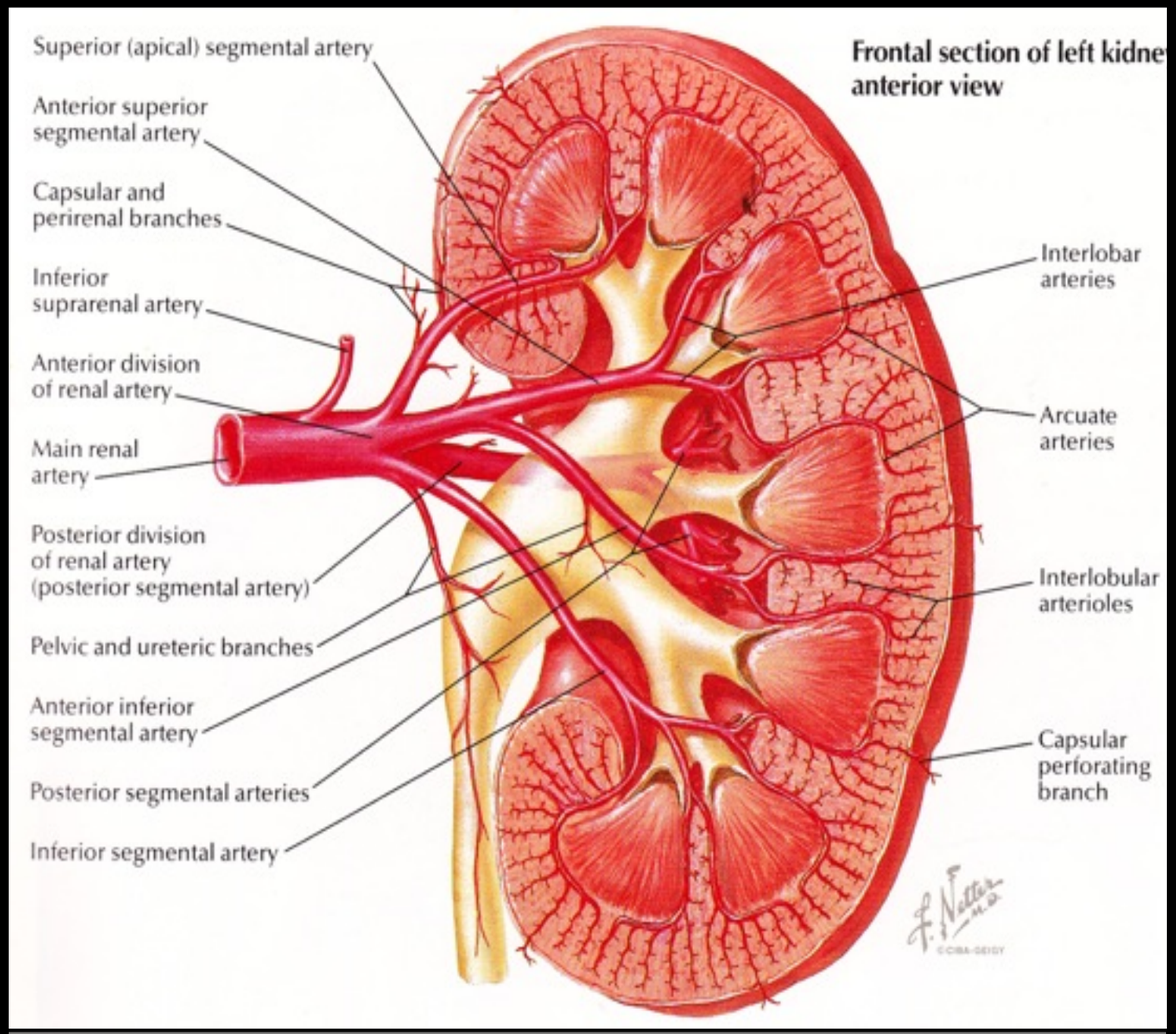
Anatomy

- spleen and liver used as windows



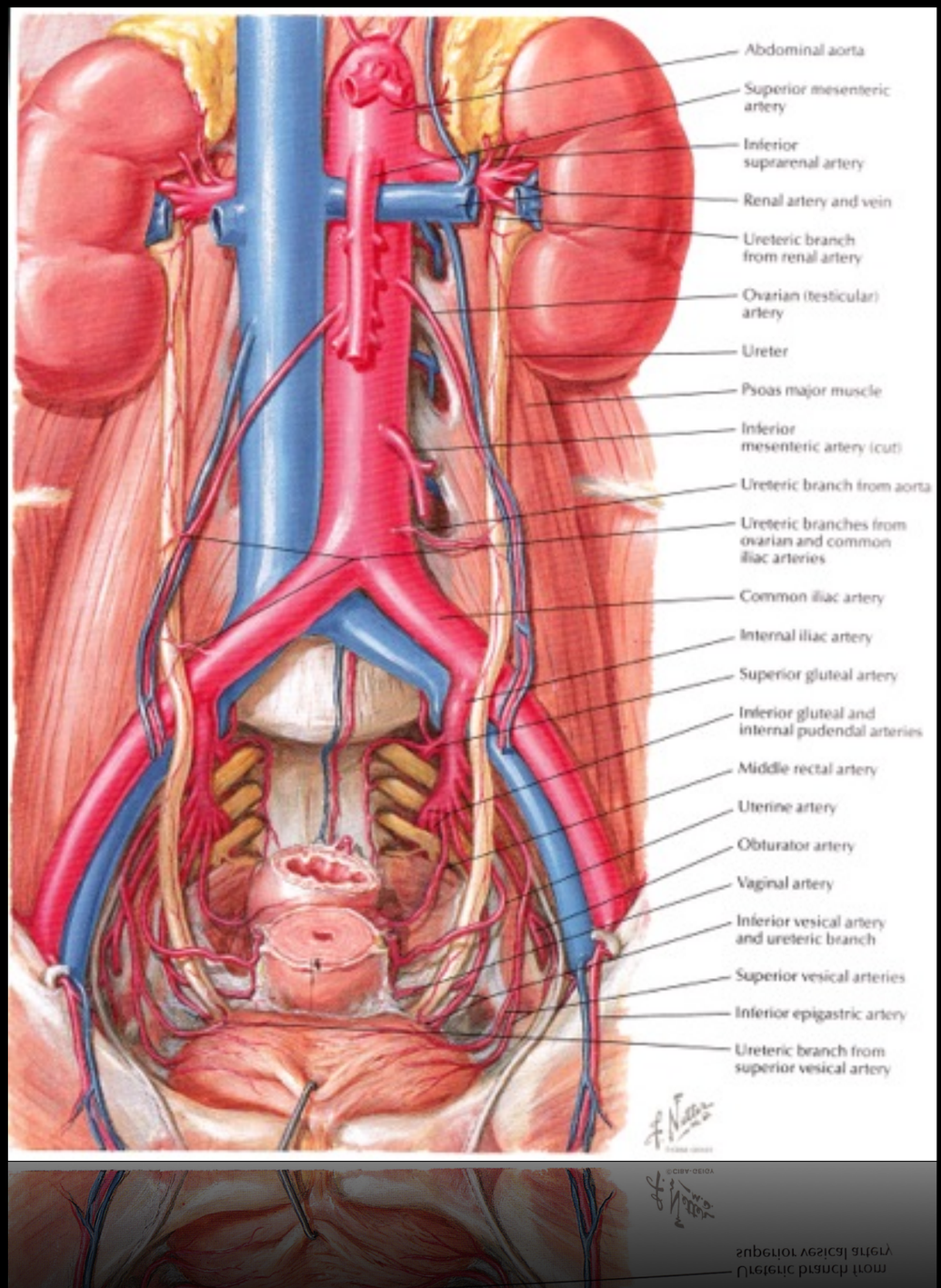
Anatomy

- cortex
- medulla
- renal pyramids
- renal pelvis



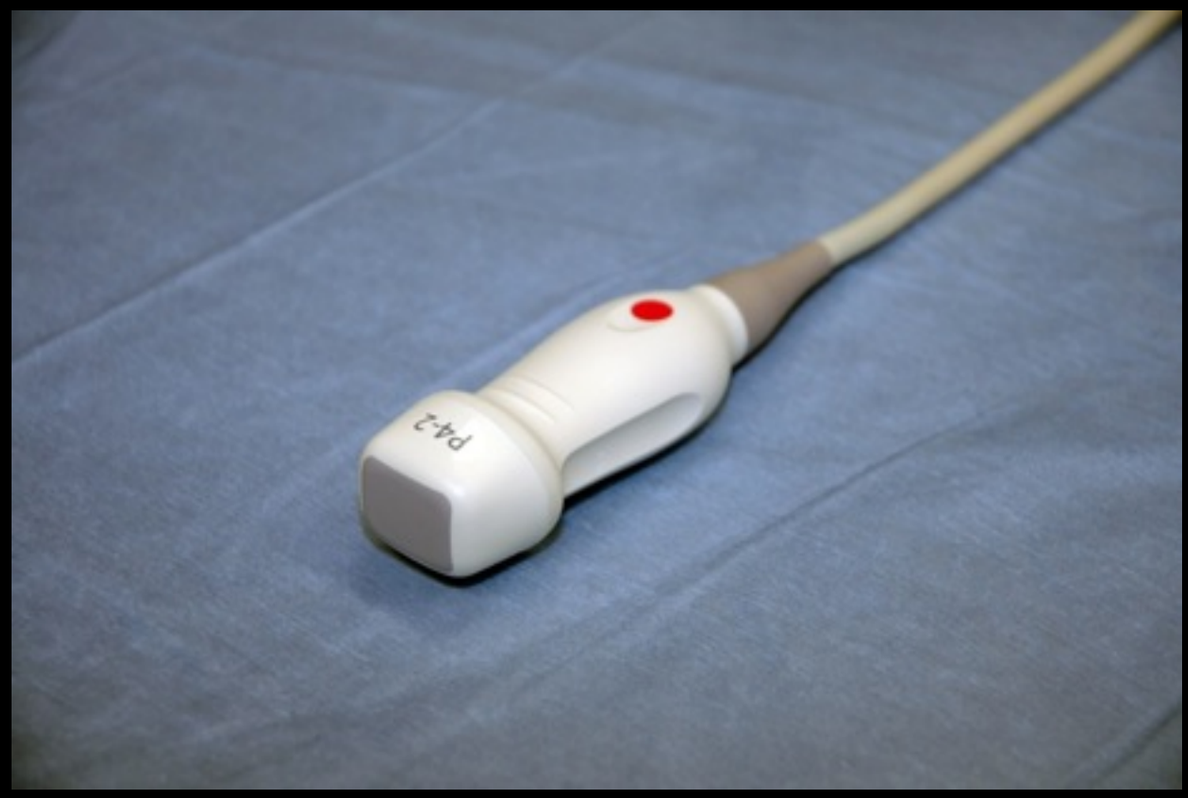
Anatomy

- ureters
  - exit renal pelvis
  - run along pelvic wall
  - cross pelvic rim
  - enter bladder posteriorly
  - usually only visible when dilated



Technical Considerations

Probes



Normal Sonographic Findings

Normal Sonographic Findings

Anatomy

- cortex: less echogenic
- medulla: more echogenic
- renal pyramids
  - variable appearance
  - dependent on hydration
  - more urine → more anechoic

Normal Sonographic Findings

Right Kidney

- use liver as a window

Normal Sonographic Findings

Right Kidney

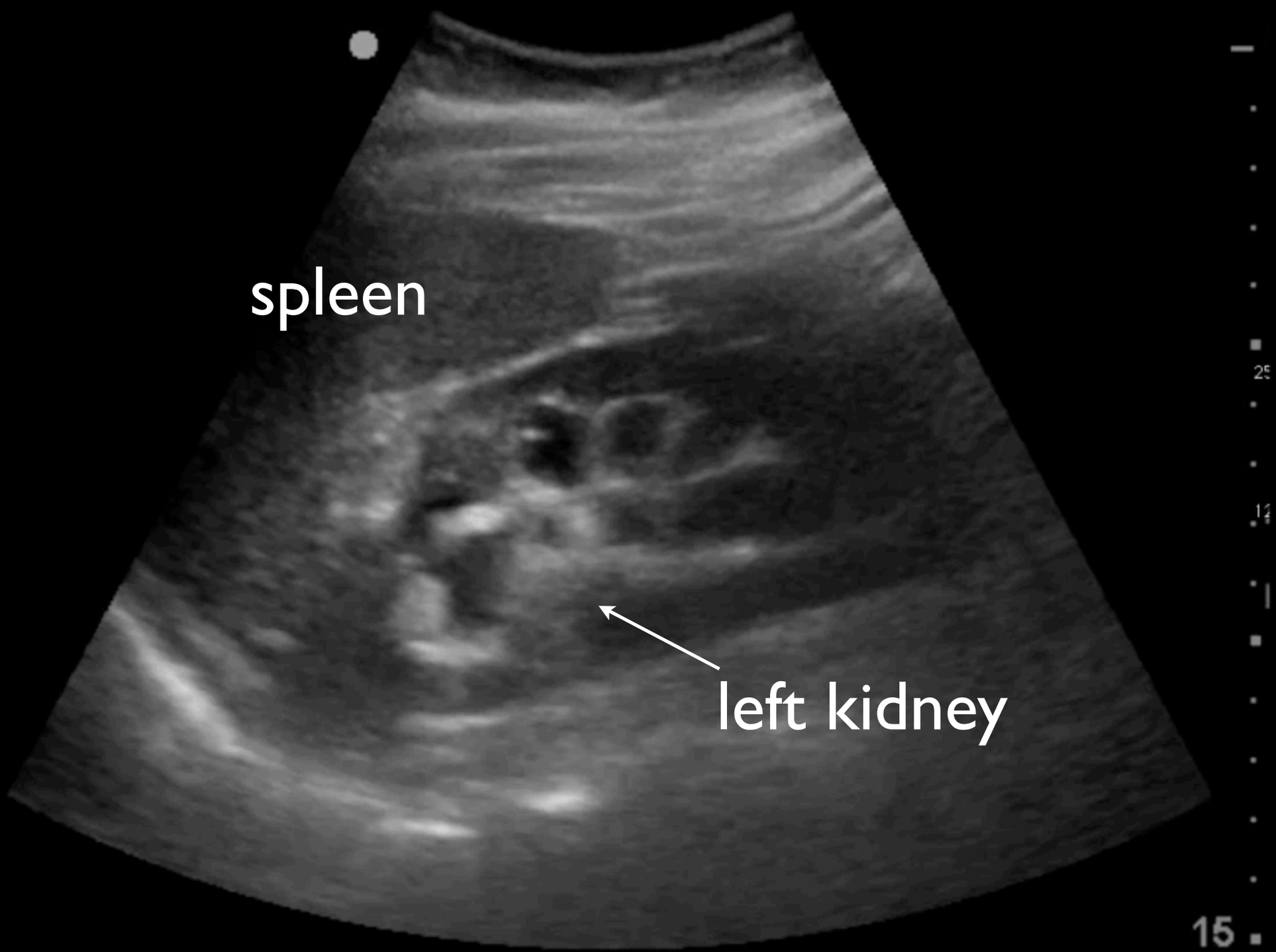
Normal Sonographic Findings

Left Kidney

- left kidney
- use spleen as

Normal Sonographic Findings

Left Kidney



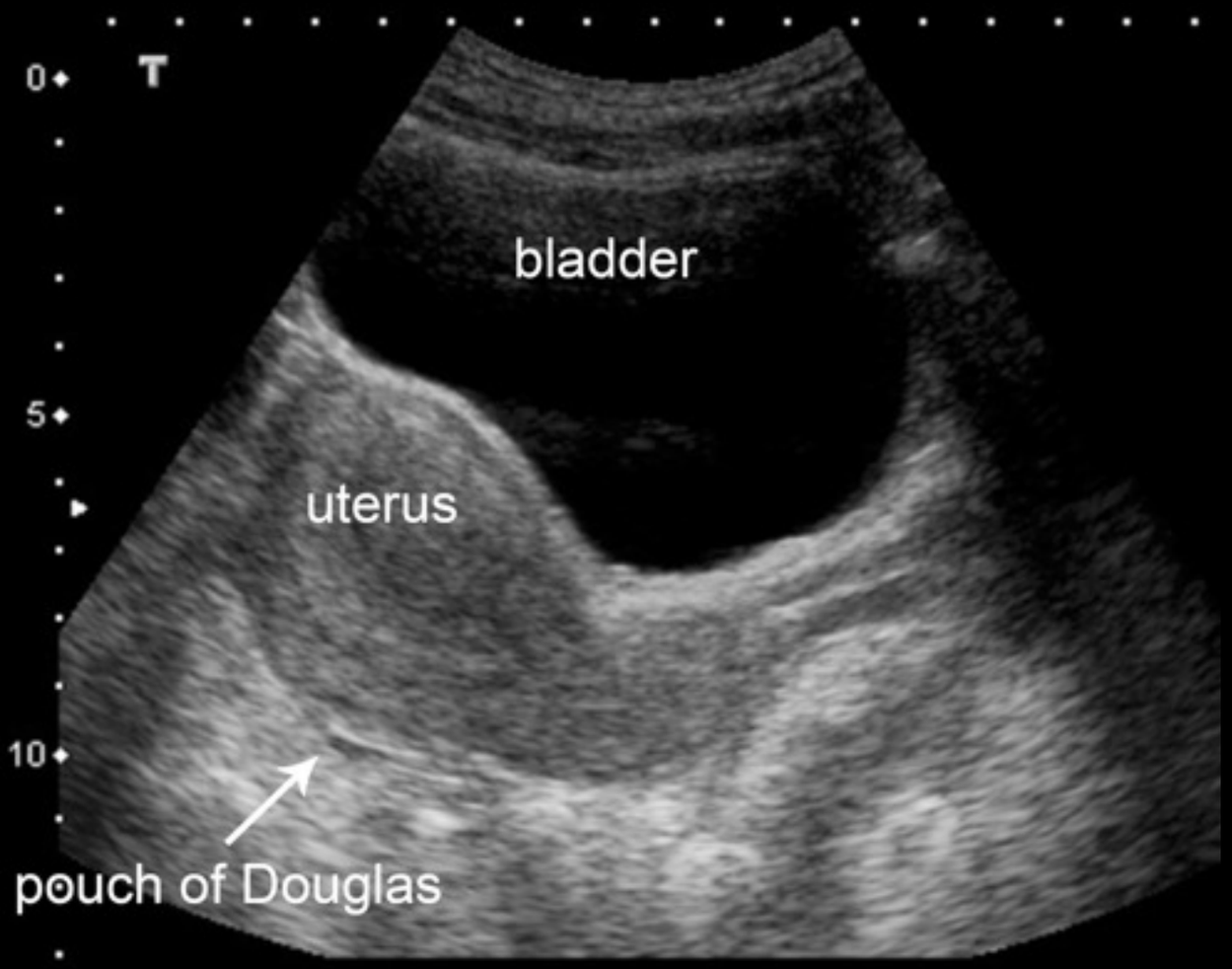
Normal Sonographic Findings

Bladder

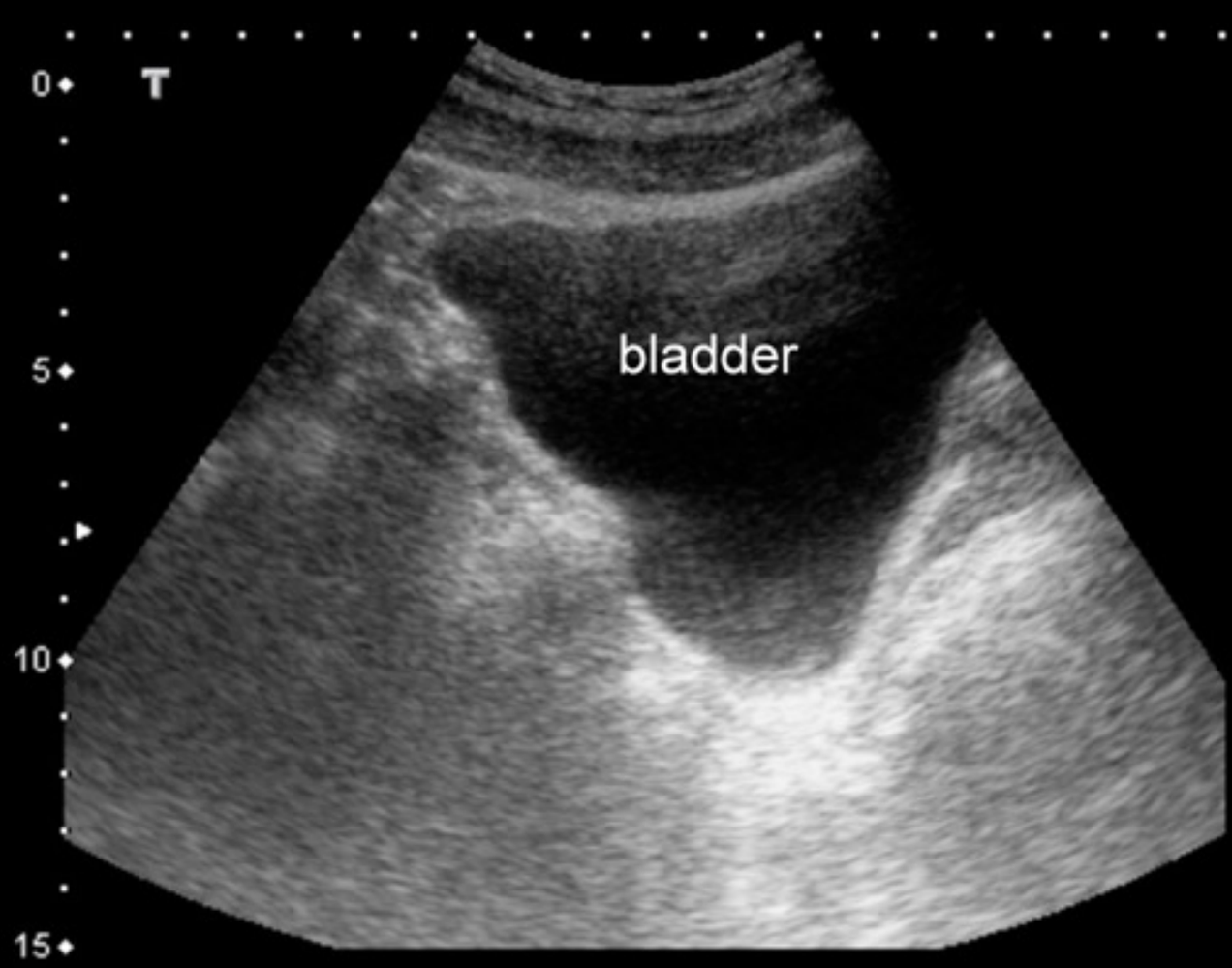
- longitudinal bladder

Normal Sonographic Findings

Bladder



female



male

Normal Sonographic Findings

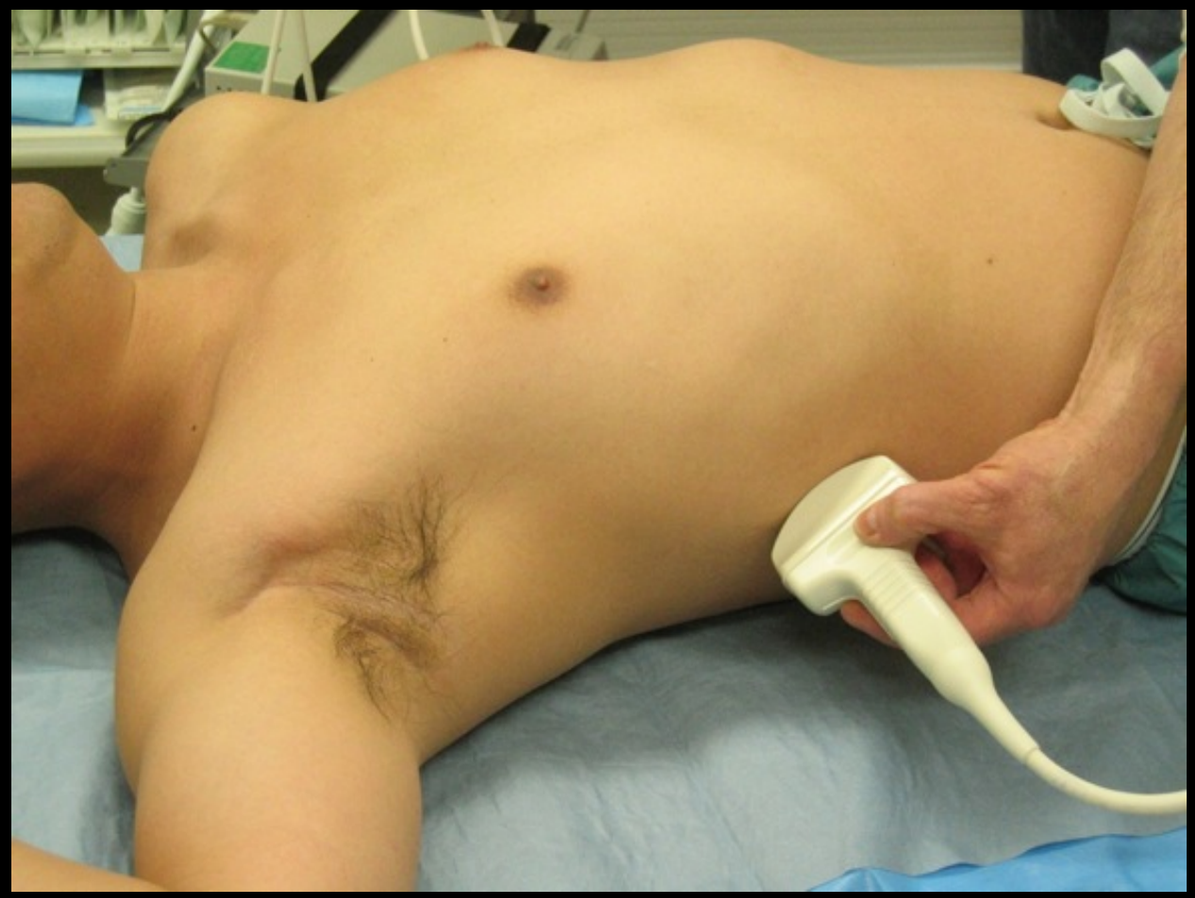
Bladder

- transverse bladder

Normal Sonographic Findings

Imaging Pearls

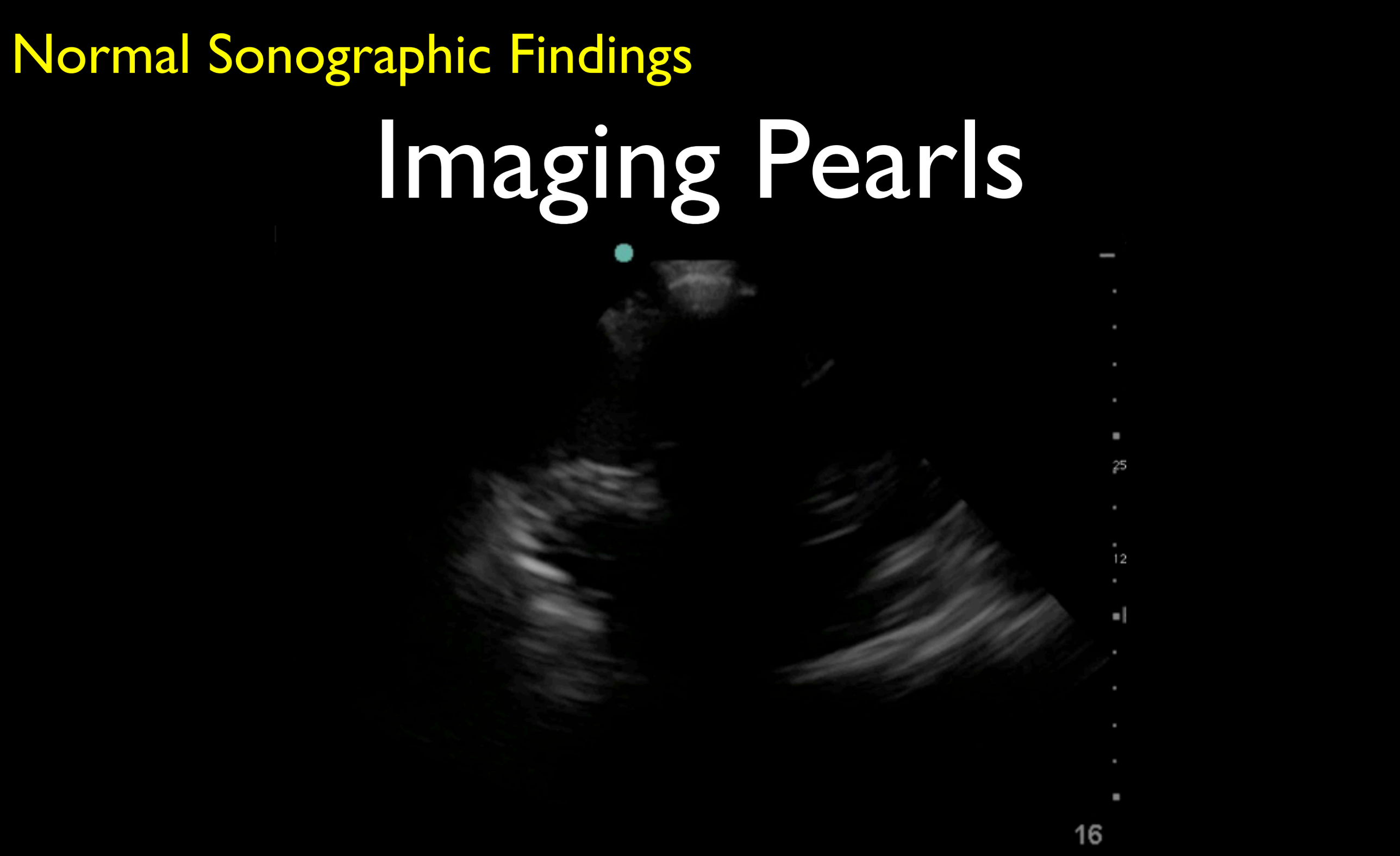
→



- rotate probe counter-clockwise to get between ribs

Normal Sonographic Findings

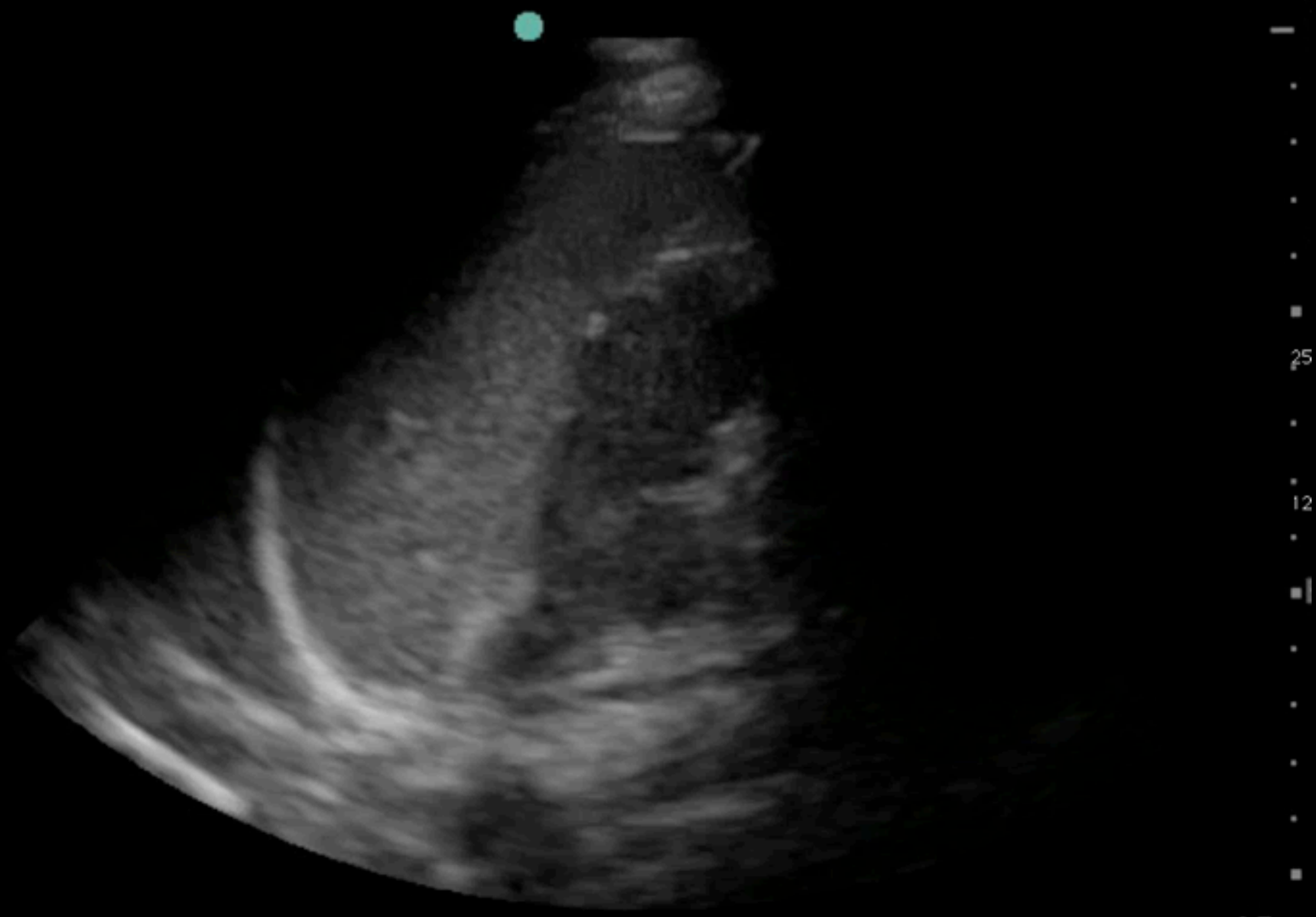
Imaging Pearls



probe rotation

Normal Sonographic Findings

Imaging Pearls



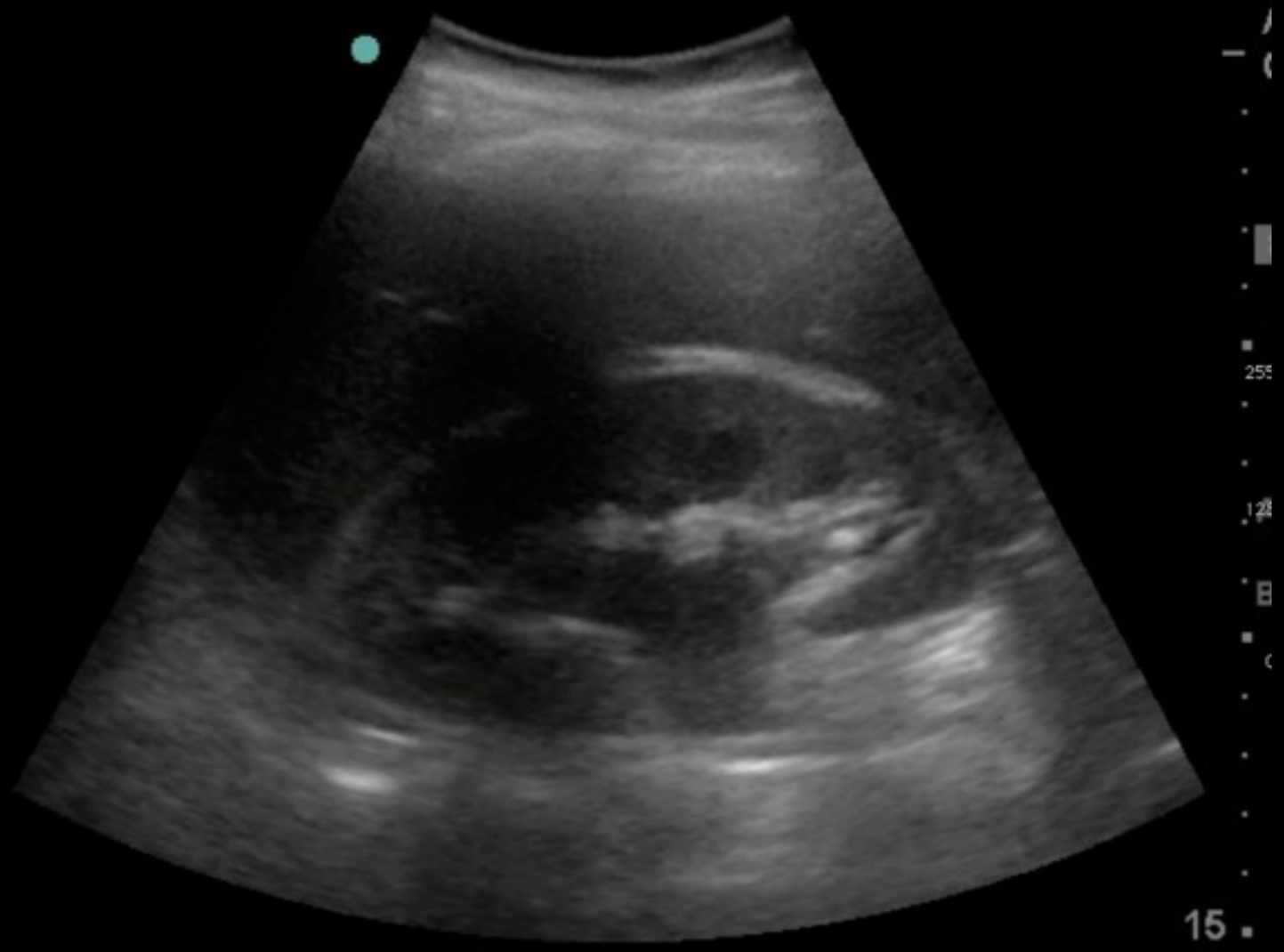
inspiration

Pathologic Sonographic Findings

Pathologic Sonographic Findings

Obstructive Uropathy

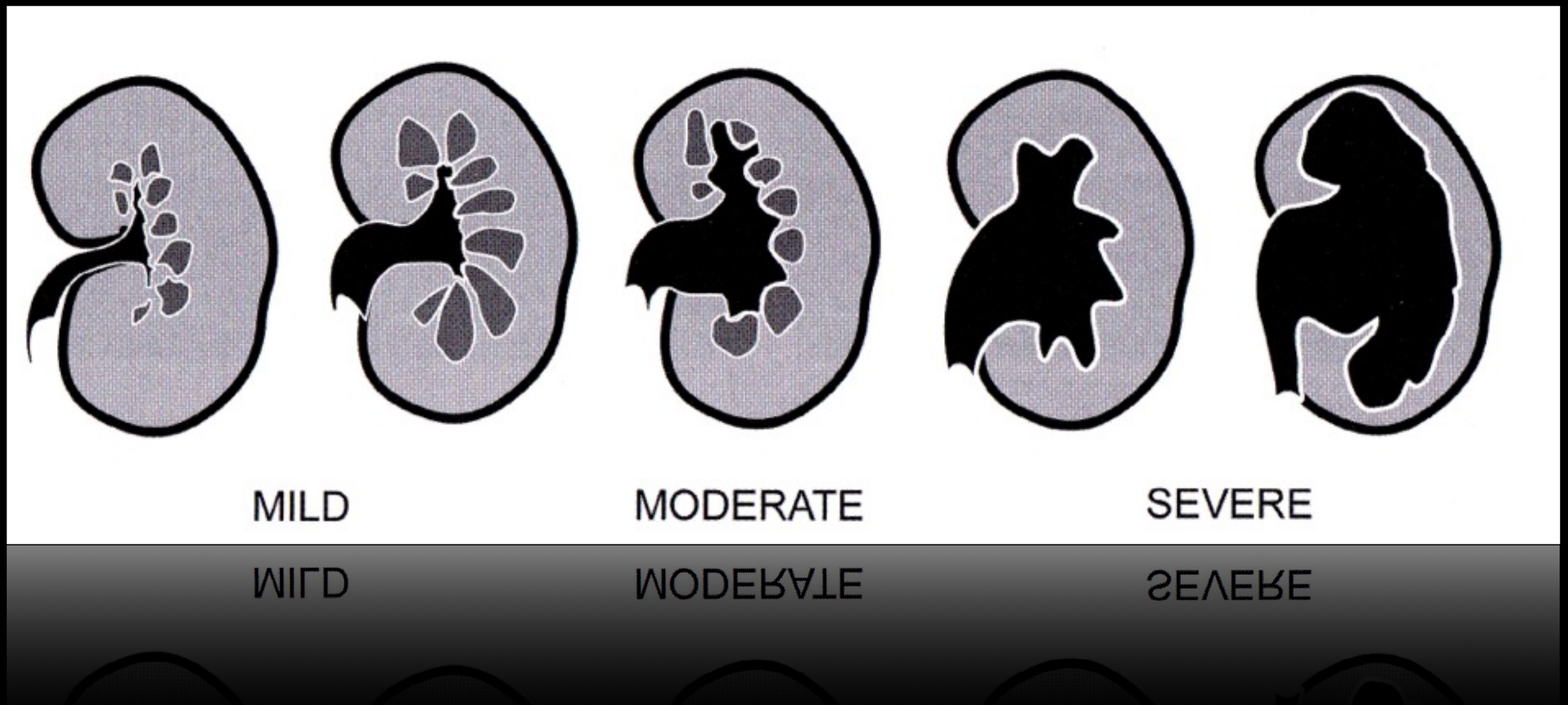
- seen on ultrasound as hydronephrosis
- etiology
  - renal stones--most common
  - masses



Pathologic Sonographic Findings

Obstructive Uropathy

- subjective grading system



Pathologic Sonographic Findings

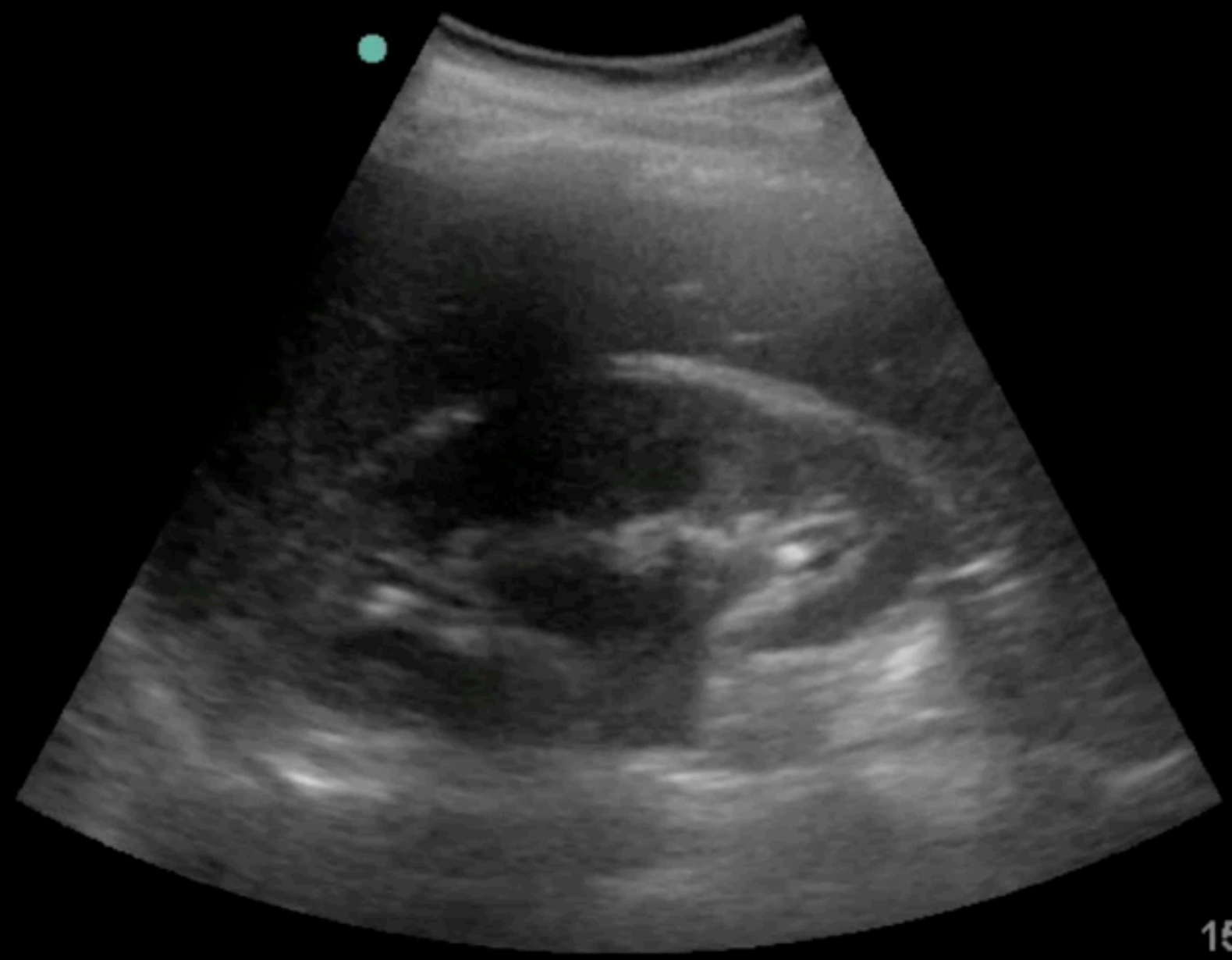
Obstructive Uropathy

- mild hydronephrosis
- minimal separation of calyceal

Pathologic Sonographic Findings

Obstructive Uropathy

- moderate hydronephrosis
- dilation of minor and major calyceal system



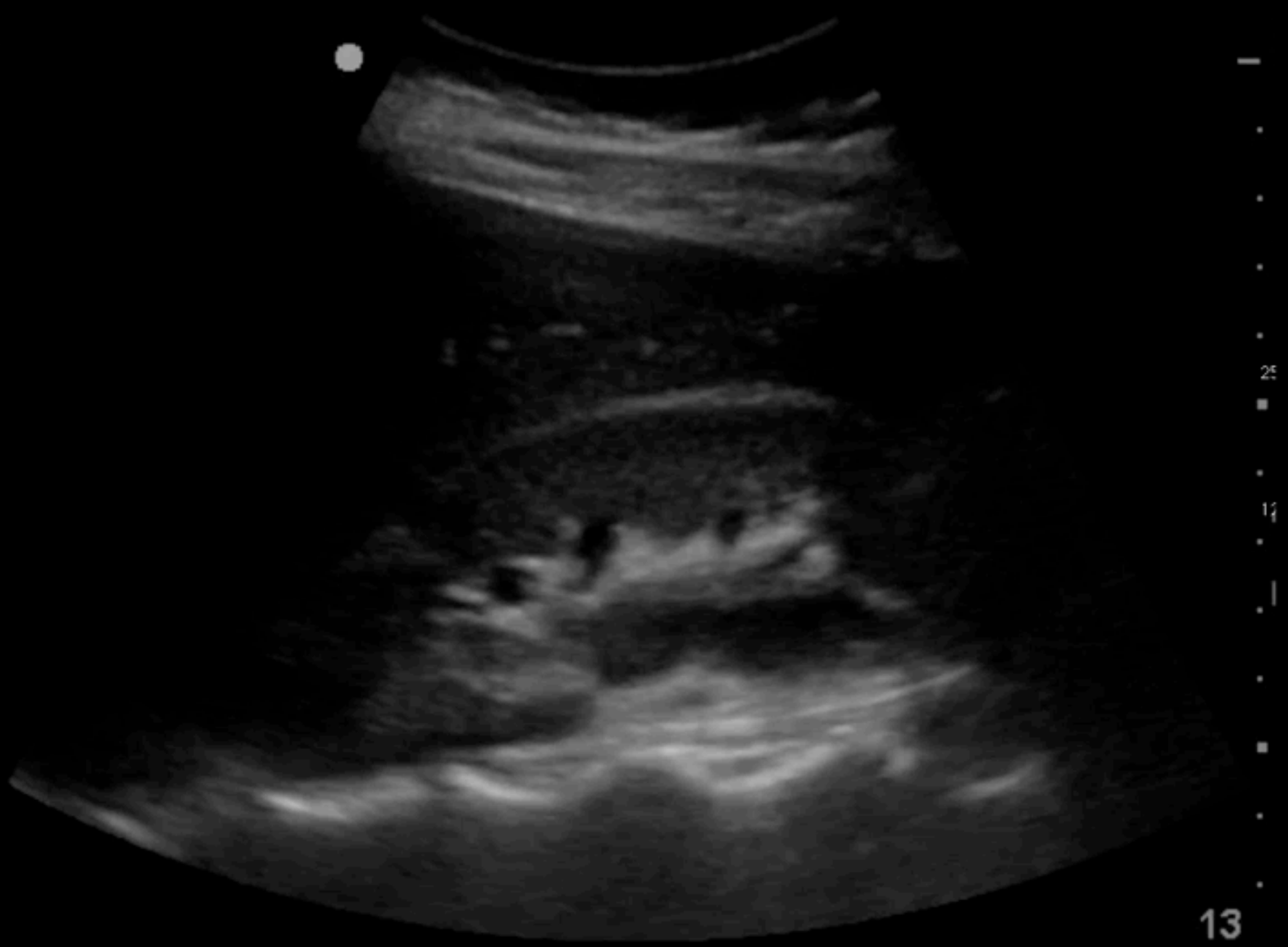
Pathologic Sonographic Findings

Obstructive Uropathy

- severe hydronephrosis
  - severe dilation, cortical thinning, loss of renal tissue

Pathologic Sonographic Findings

Obstructive Uropathy



hydroureter

Pathologic Sonographic Findings

Obstructive Uropathy

hydroureter

Pathologic Sonographic Findings

Obstructive Uropathy

calyceal rupture

Pathologic Sonographic Findings

Obstructive Uropathy

longitudinal

transverse

intrarenal stone

Pathologic Sonographic Findings

Obstructive Uropathy

proximal ureteral stone

Pathologic Sonographic Findings

Obstructive Uropathy

- ureteral stones not usually visible
- hydronephrosis depends on degree of hydration
- may be absent with stones until hydrated
- may be present in normal patients with full bladder

Pathologic Sonographic Findings

Obstructive Uropathy

- hydronephrosis may be:
  - acute, unilateral → kidney stones
  - chronic, bilateral → mass

Pathologic Sonographic Findings

Obstructive Uropathy

unilateral flank pain, hematuria

hydronephrosis

h/o stones

hydrate, medicate, home

no h/o stones

CT

no hydronephrosis

hydration, CT

no hydronephrosis, no calculus

consider alternate diagnosis

Pathologic Sonographic Findings

Obstructive Uropathy

- algorithm may change depending on:
  - age
  - duration of pain
  - degree of hydronephrosis

Pathologic Sonographic Findings

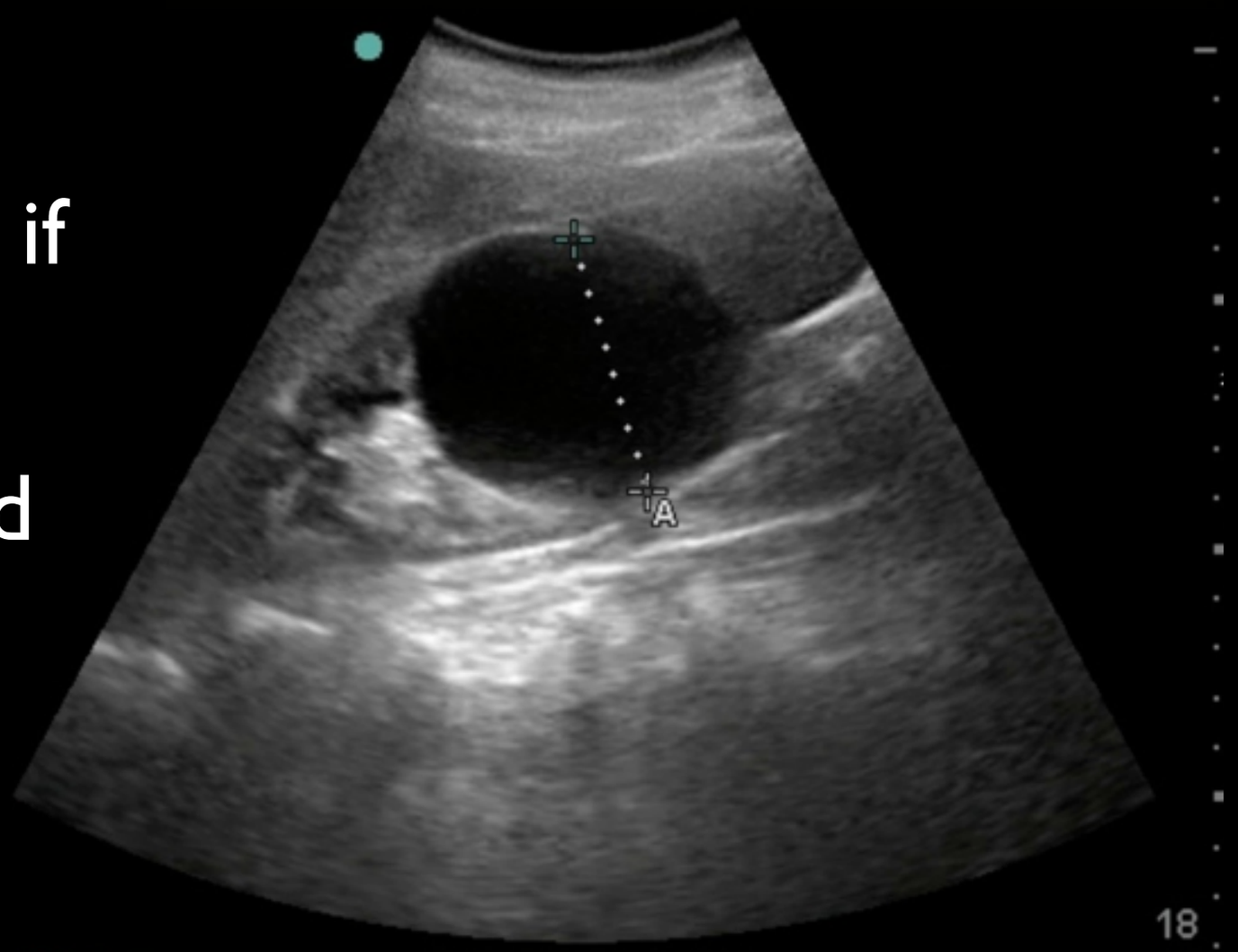
Renal Masses

- renal cysts
  - extremely common
  - must have:
    - smooth, round surface
    - no internal echoes
    - well defined interface
    - posterior acoustic

Pathologic Sonographic Findings

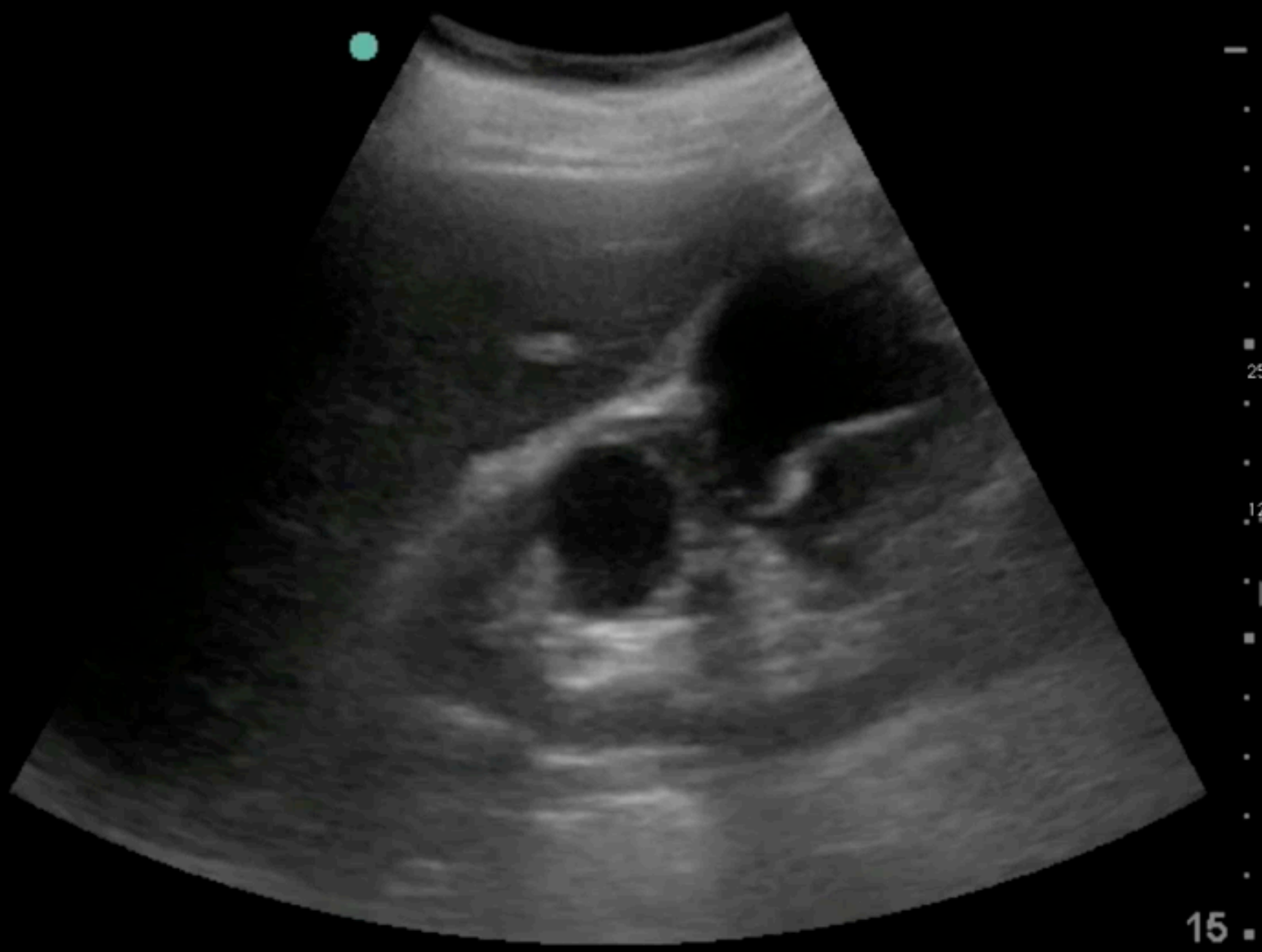
Renal Masses

- very rarely clinical significant
- get radiologic study if unsure
- can become infected
  - fever
  - infected urine
  - may form abscess



Pathologic Sonographic Findings

Renal Masses



internal echo

Pathologic Sonographic Findings

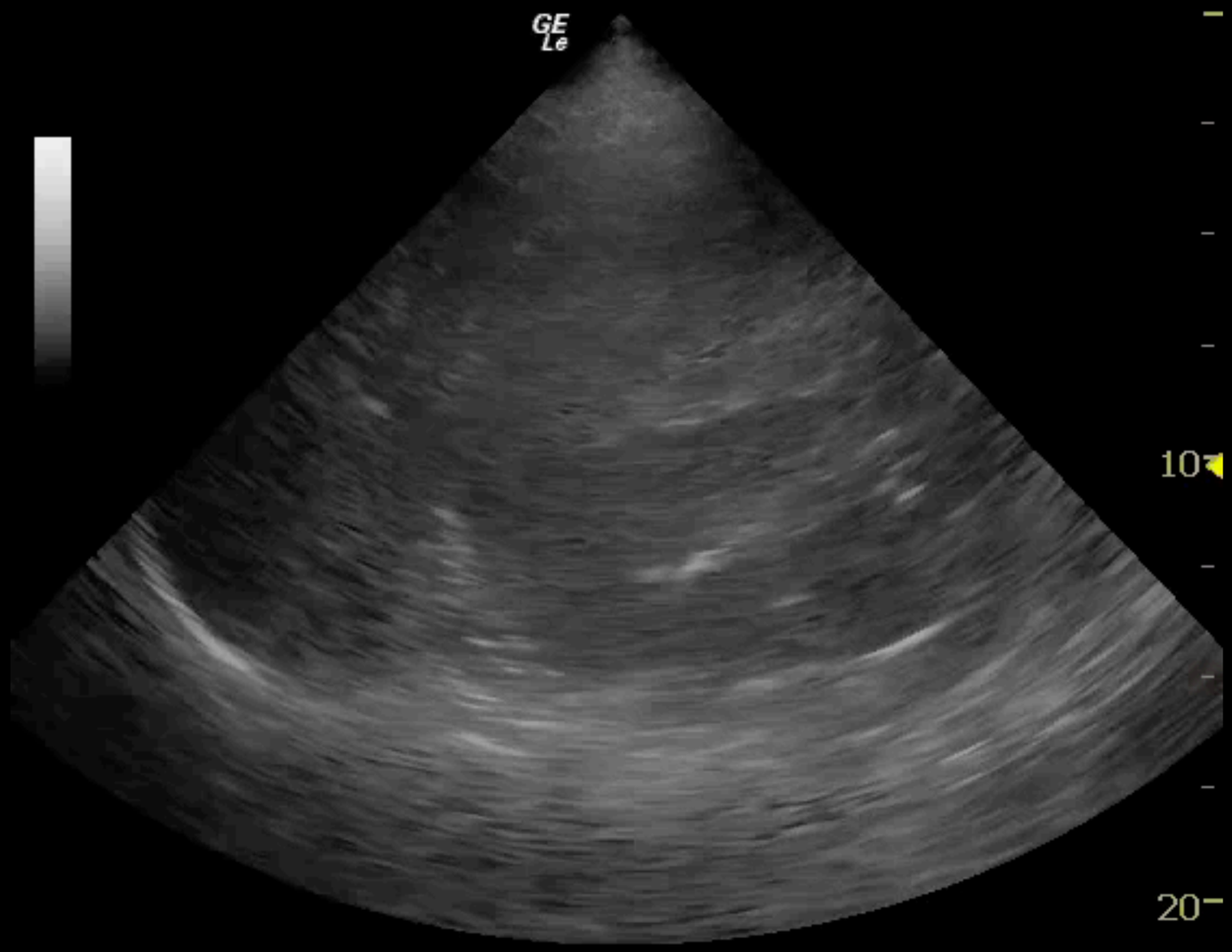
Renal Masses

polycystic kidney

Pathologic Sonographic Findings

Renal Masses

- majority of malignancies are renal cell carcinoma
- heterogenous
- isoechoic, hyperechoic, or anechoic
- indistinct borders
- poorly defined interface

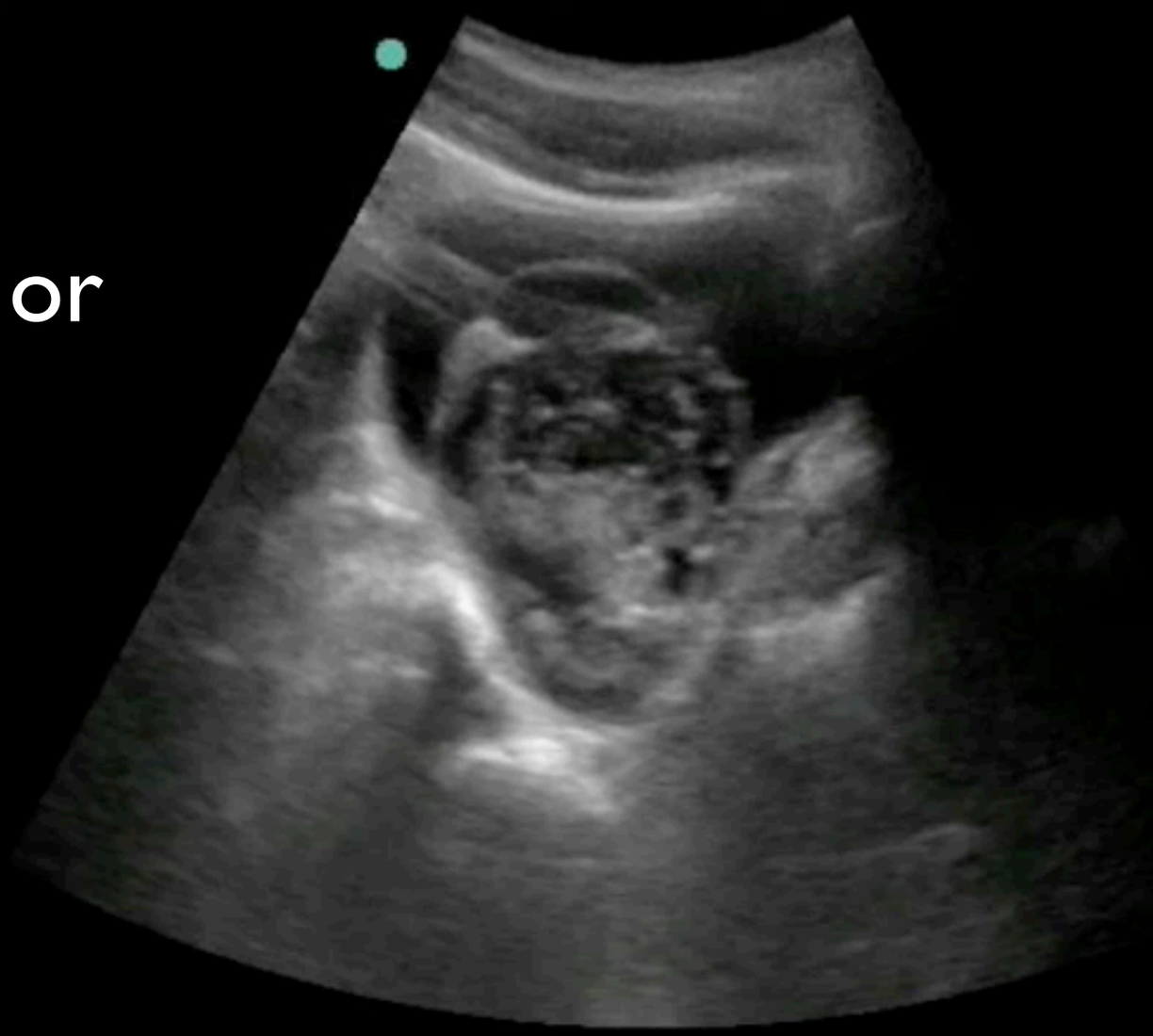


Get a CT!

Pathologic Sonographic Findings

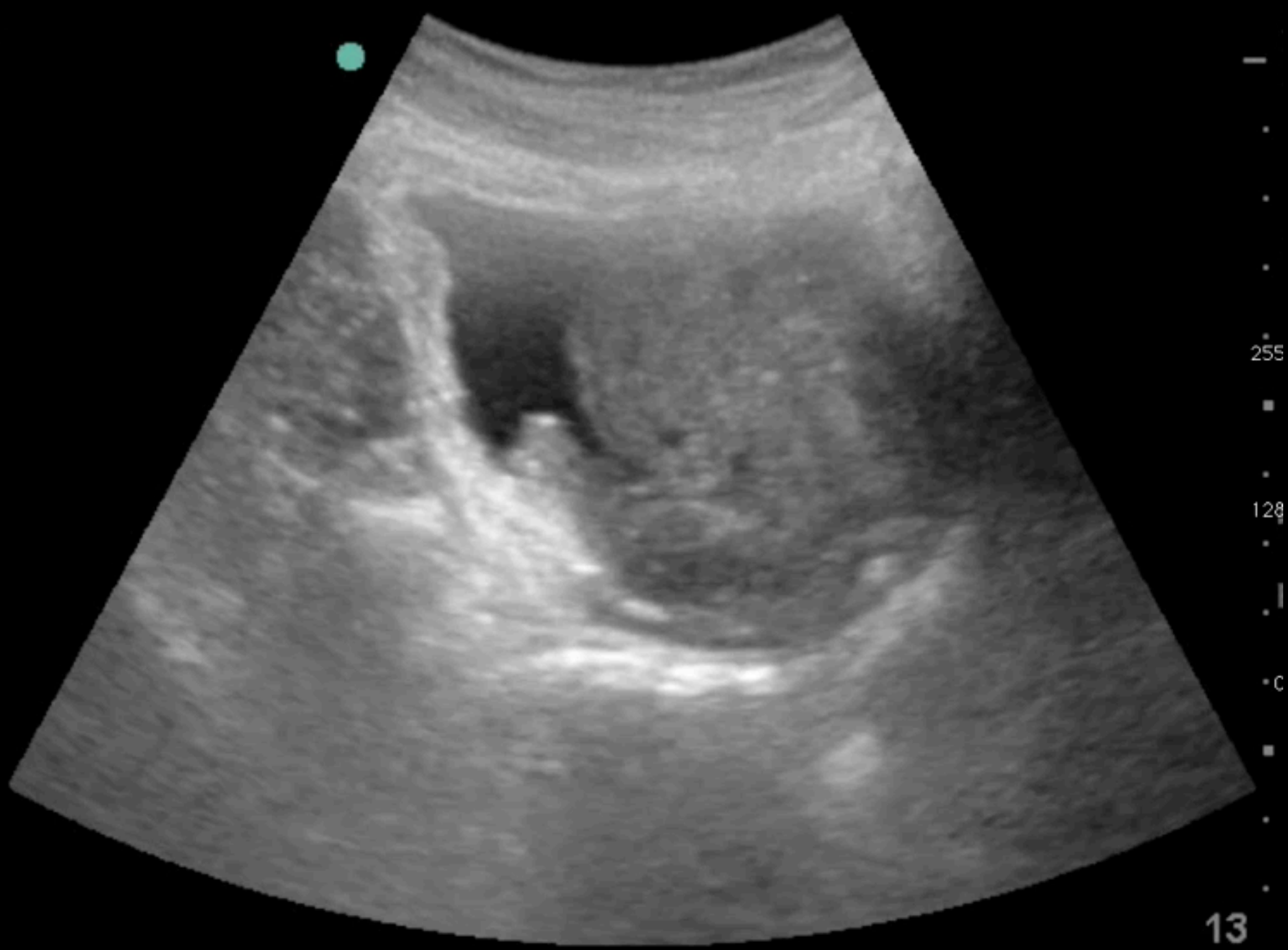
Bladder Masses

- may be benign or malignant
- focal wall thickening or irregular echogenic mass projecting into lumen
- assess kidneys for obstruction



Pathologic Sonographic Findings

Bladder Masses



Pathologic Sonographic Findings

Bladder Hematomas

- may present as clotted foley, obstructive symptoms
- hematuria
- s/p radiation or instrumentation

Pathologic Sonographic Findings

Bladder Hematomas

- layering along wall or irregular echogenic mass projecting into lumen
- assess kidneys for obstruction

Pathologic Sonographic Findings

Bladder Hematomas

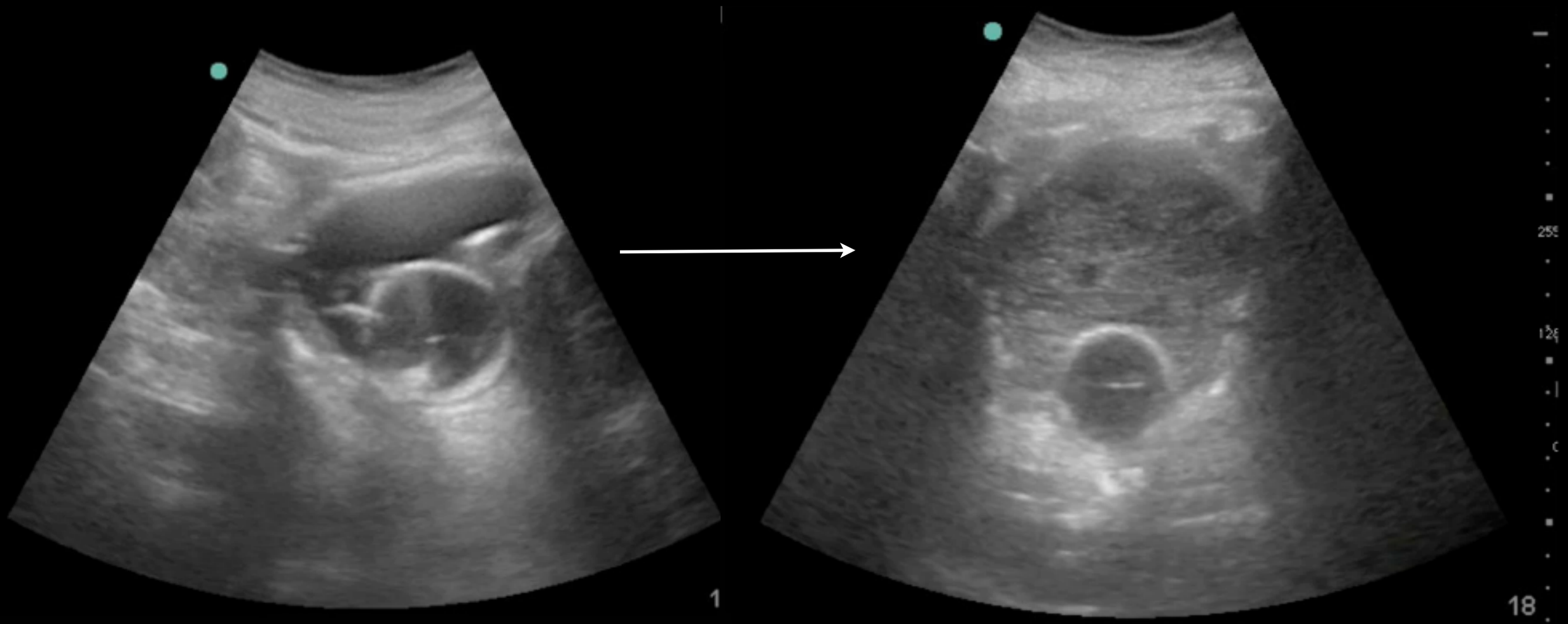
same sonographic characteristics as masses

Pathologic Sonographic Findings

Bladder Masses

Pathologic Sonographic Findings

Bladder Hematomas



irrigation with agitated saline

Pathologic Sonographic Findings

Acute Urinary Retention

- differentiate retention from renal failure
- large distended bladder mandates foley catheterization
- empty or small bladder suggests another cause
- volume measurements may be helpful
- image kidneys for hydronephrosis

Pathologic Sonographic Findings

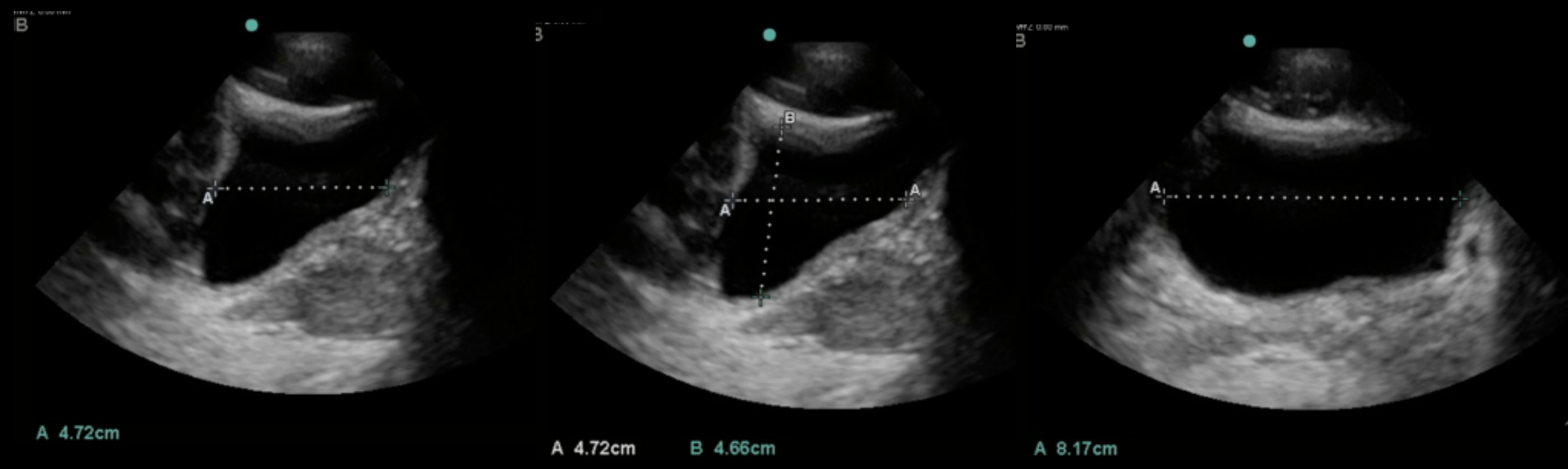
Acute Urinary Retention

L x W x H x.75

Pathologic Sonographic Findings

Acute Urinary Retention

bladder size estimation



L x W x H x .75

Pitfalls

Pitfalls

Masked Hydronephrosis

- after acute obstruction, hydronephrosis may take several hours to develop
- presence of hydronephrosis may be masked by dehydration

Pitfalls

Hydronephrosis Mimics

- full bladder
- pregnancy induced smooth muscle relaxation
- extrarenal pelvis
- post-obstructive dilatation
- congenital megacalyces

Pitfalls

Solid Masses

- solid mass characteristics
- it is beyond the scope of most clinical physicians using ultrasound to classify non-cystic renal masses

Get a CT scan

Cases

Acute Flank Pain #1

- 38 y/o male presents at 3AM with 2 hours of severe left flank pain and vomiting.
- no gross hematuria, dysuria
- in significant pain
- 140/80, 110, 10, 98.0
- L. CVA tenderness

Acute Flank Pain #1

- IV analgesia, IVF
- urine dip with +blood

Cases

Acute Flank Pain #1

right

left

Acute Flank Pain #1

- Pain controlled in ED
- Discharged to follow up with urologist

Acute Flank Pain #2

- 78 y/o male with L. flank pain x2 hours.
- no nausea, vomiting, or urinary symptoms.
- h/o nephrolithiasis requiring extraction 10 years prior
- moderate distress
- 160/90, 110, 12, 98.0

Cases

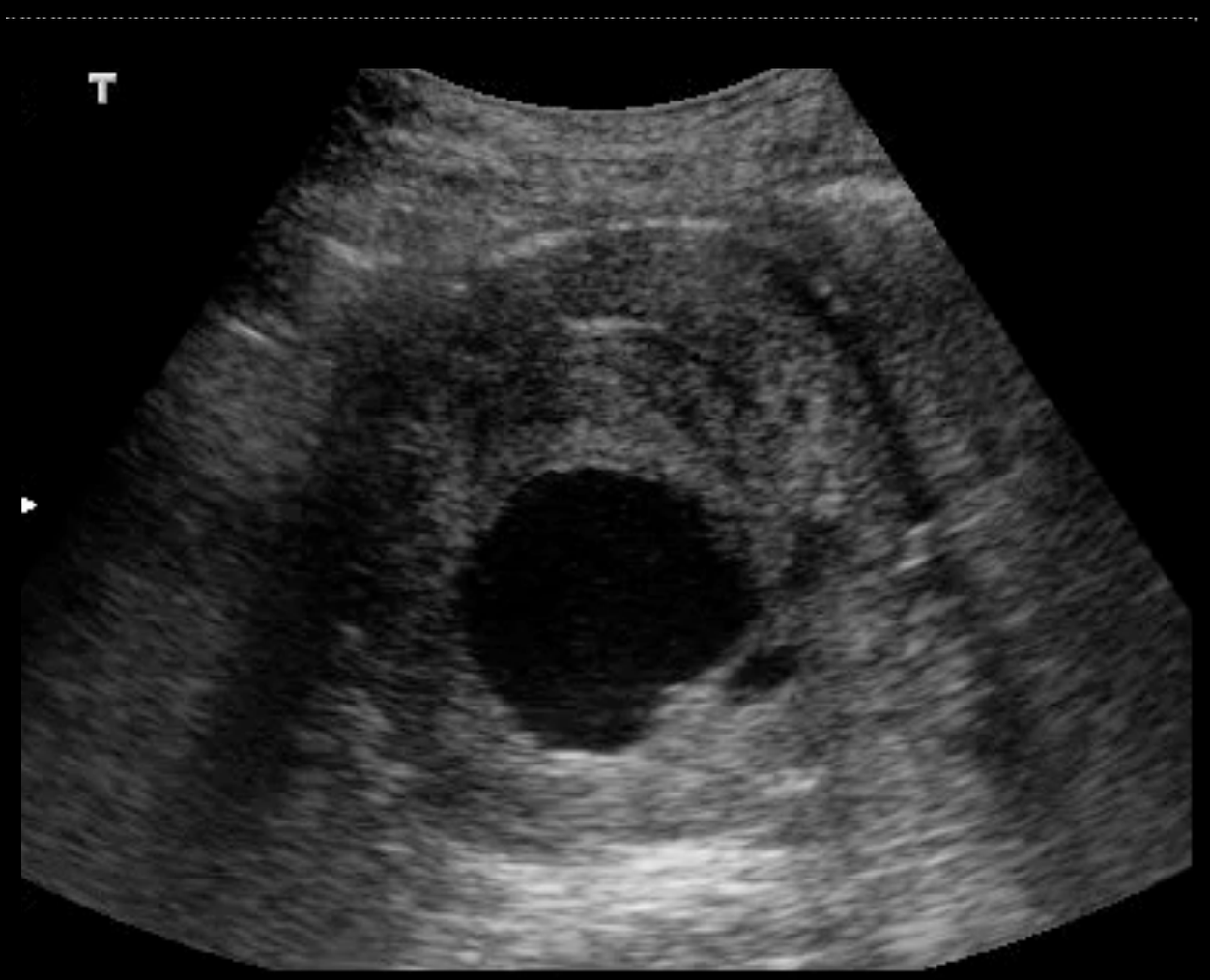
Acute Flank Pain #2

- EKG unremarkable, labs ordered
- ultrasound performed

Cases

Acute Flank Pain #2

left kidney



aorta

Cases

Acute Flank Pain #2

- aorta measures 8.9cm
- vascular surgery notified, patient taken to OR within 40 minutes
- extensive retroperitoneal rupture
- successful repair, eventually discharged

Summary

Final Thoughts

- Useful initial screening tool for flank pain
- Remember false positives/negatives for hydronephrosis
- CT is still useful!
- Renal cysts are common
  - others masses need further evaluation

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