Sonographic assessment of urinary tract tumours

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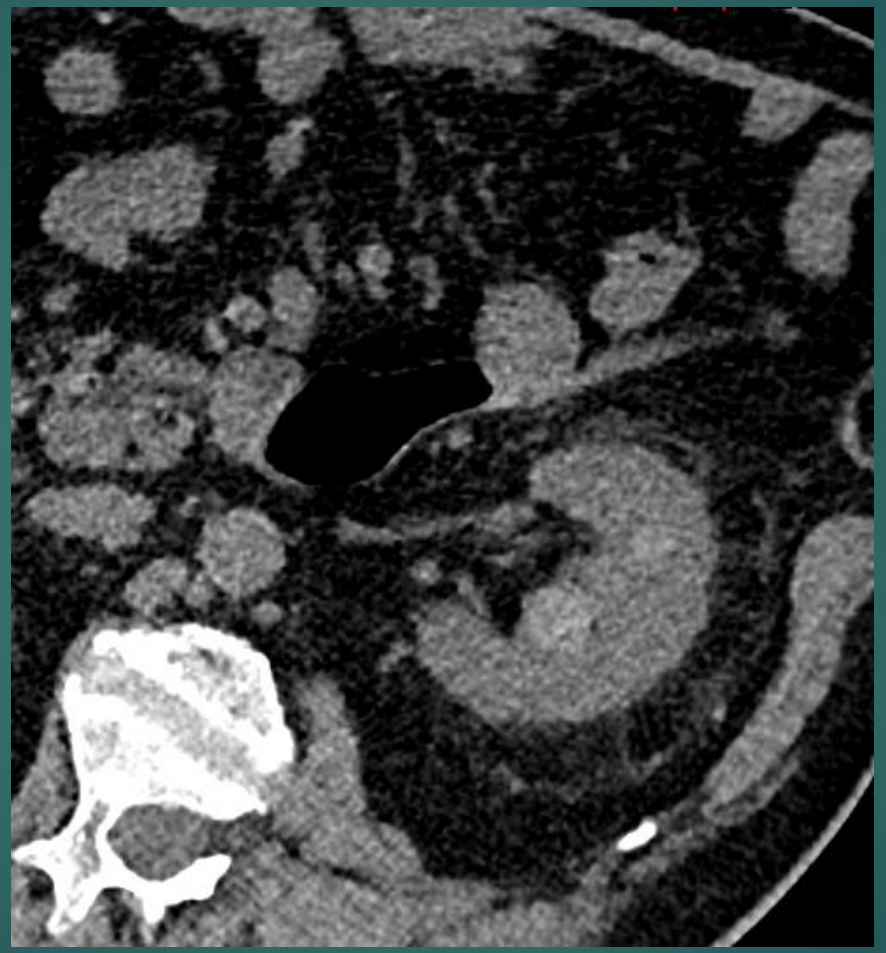
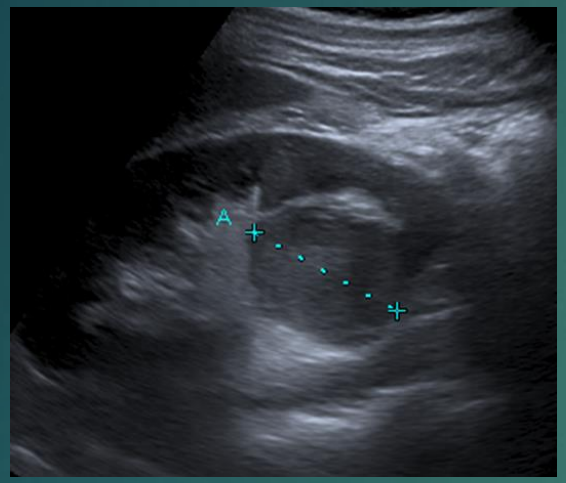
Renal Lesions

- Exponential growth of imaging continues to feed a marked increase in the detection of renal lesions.
- >70% RCC are incidentally detected- mostly by US.
- Huge number of cystic (40 % of all patients have at least 1 cyst) and 'indeterminate' renal lesions detected by US.
- How confidently do we characterise them?

Hyperdense Renal Lesions

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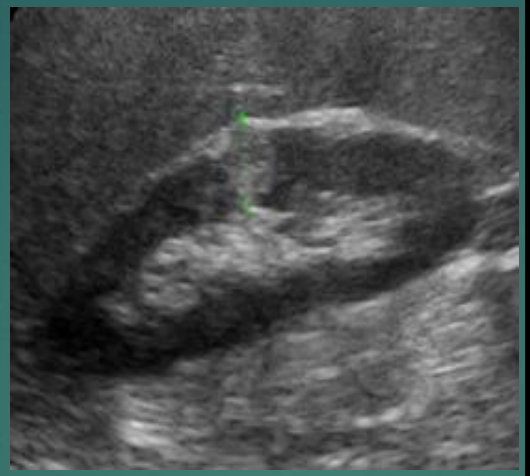

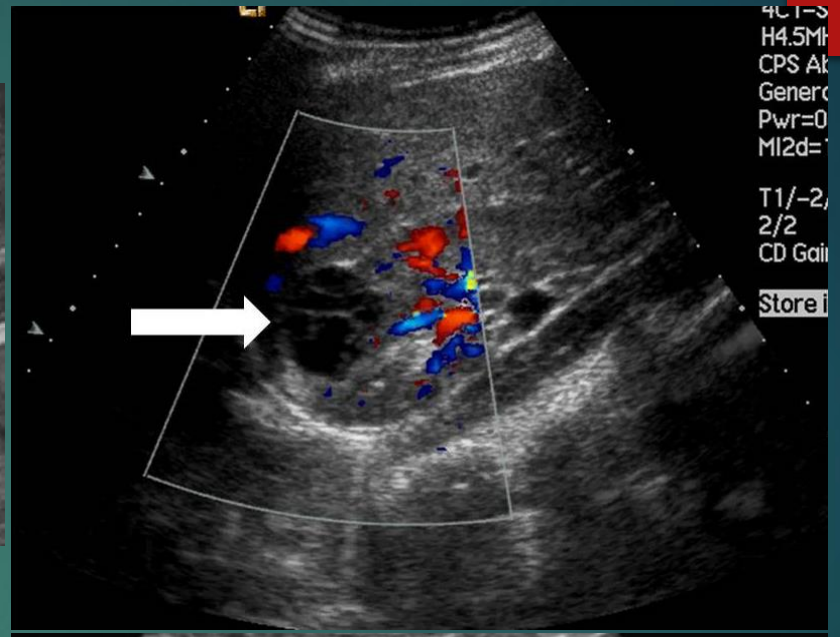
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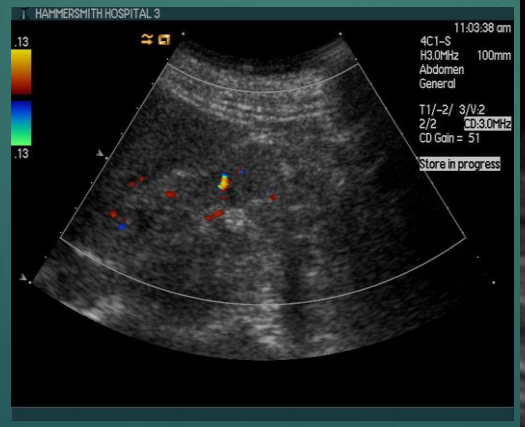
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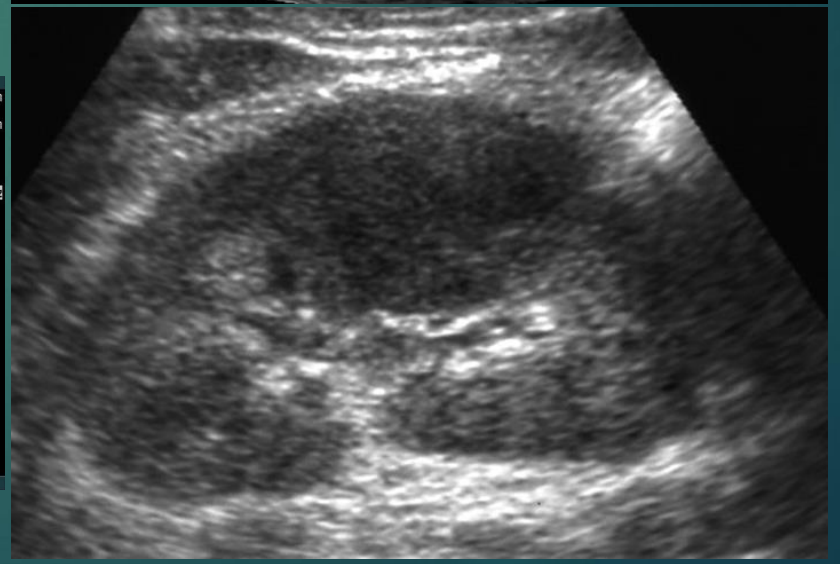
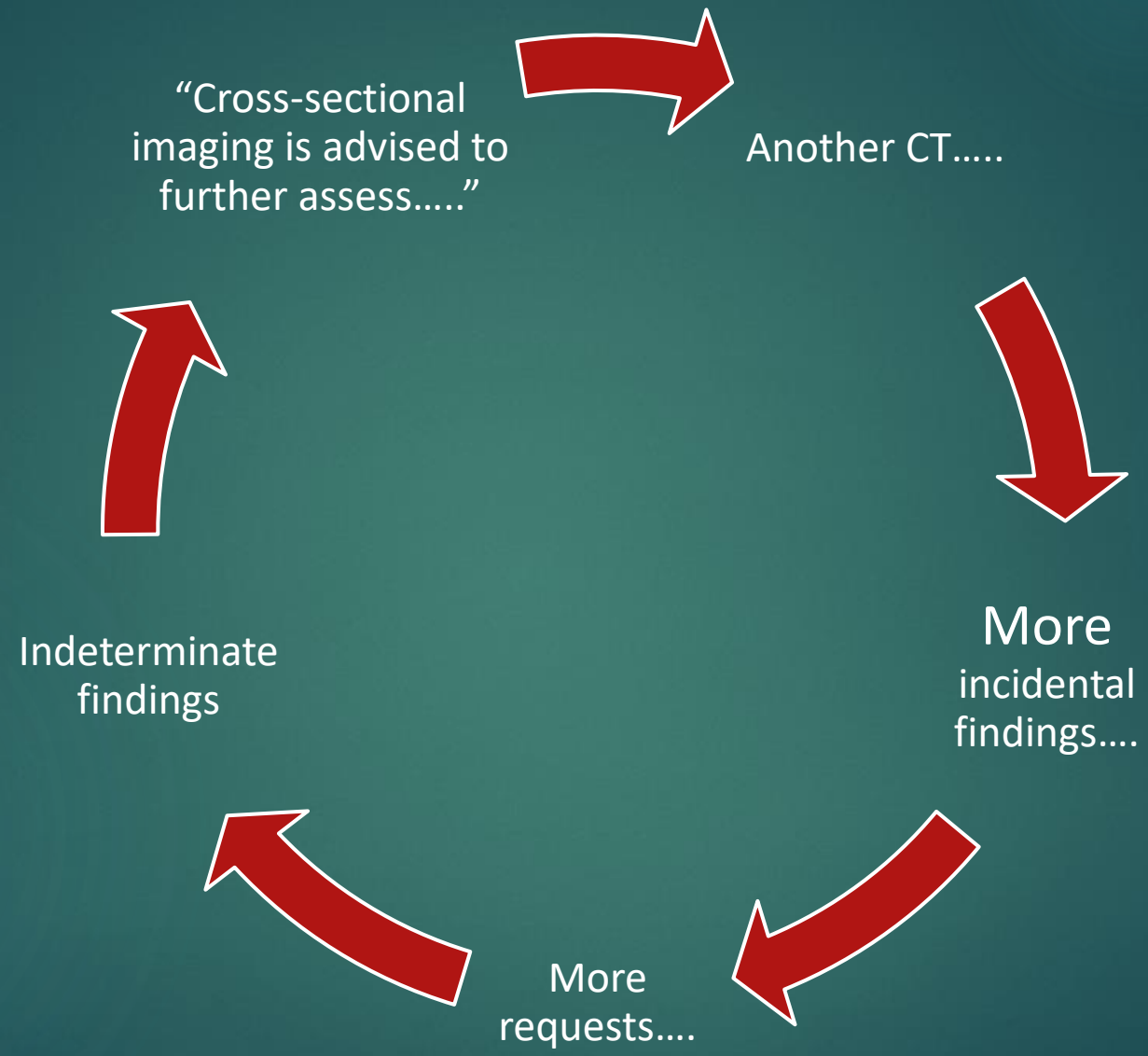



“Cross-sectional imaging is advised to further assess…..”
Another CT…..
More incidental findings….
More requests….
Indeterminate findings

Incidental Lesion

- Significant proportion referred to CT and MR for characterisation- large cost- financial and time... stress
- US should more easily distinguish simple cystic from complex or solid lesions
- Limited FOV on US depending on body habitus

Renal Lesions

Pseudolesions

Dromedary Hump

Fetal Lobulation

Prominent Column of Bertin

Focal Pyelonephritis

Benign

"Cyst"

AML

Oncocytoma

Malignant

RCC

TCC

Metastasis

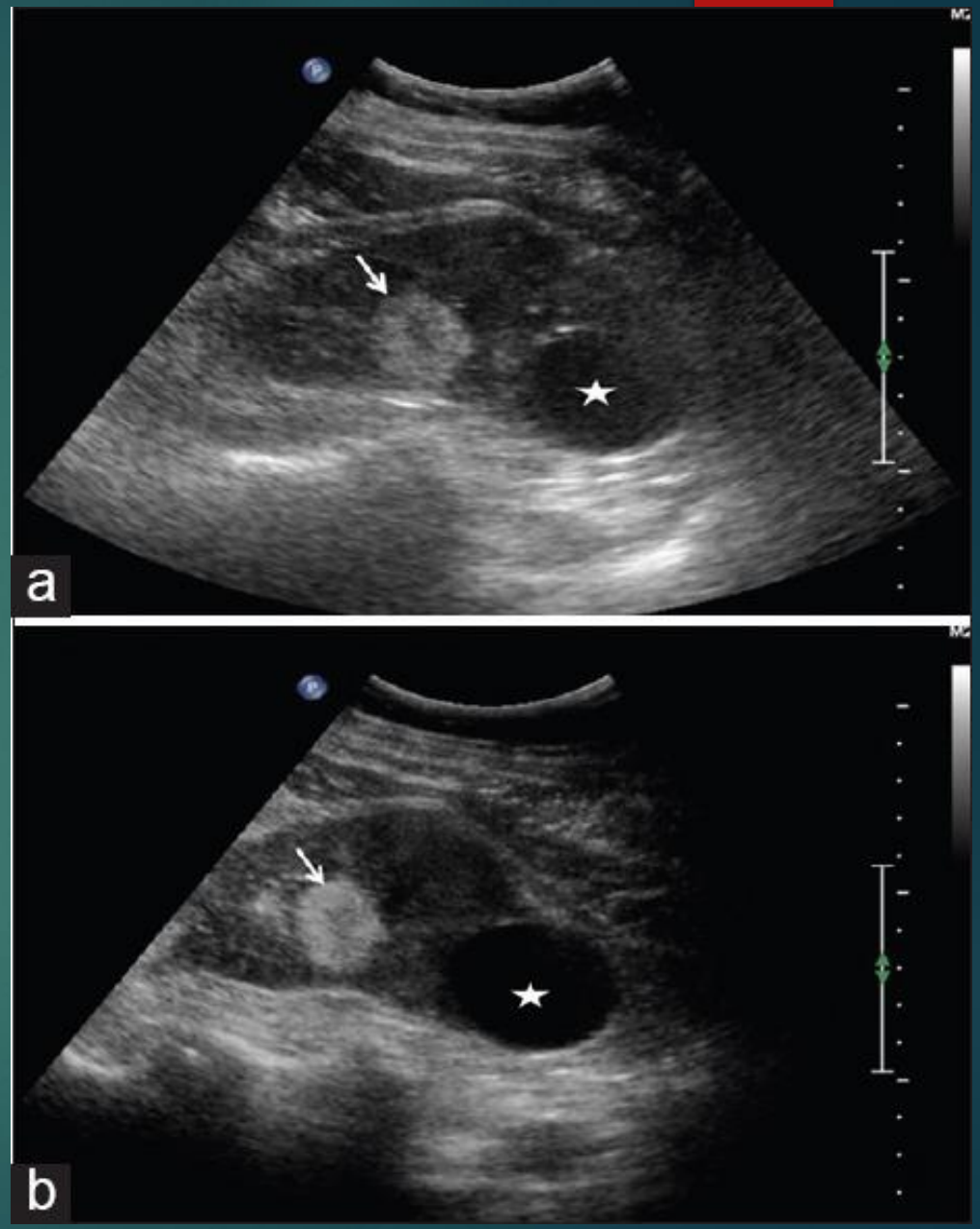
Lymphoma

Available Tools

- Standard B-mode US
- Tissue Harmonic imaging (THI)
- Color Flow Doppler / Microvascular flow
- Fusion (US to CT / MRI)
- Contrast Enhanced Ultrasound (CEUS)

Harmonic Imaging

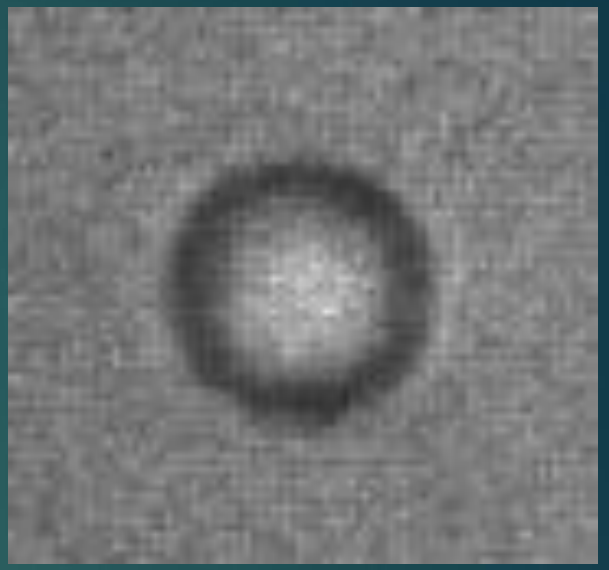
- Enhances signal:noise ratio
- Removes reverberation and side lobe artefacts
- Improves contrast resolution
- Good for obese patient as harmonics are preferentially produced from deeper tissues.



Improved conspicuity of a cyst and AML with harm
Lal A et al Indian J of Urol 2015; 13:176

Microbubbles

- Bubble of gas surrounded by a shell
- Diameter 1-7 μm
- Vascular markers
- Resonant Frequency 2-15 MHz
- Real-time low MI modes to ↓ destruction
- Very safe: No nephrotoxicity. Can use in renal failure and obstruction
- Use when CT/MR agents contraindicated

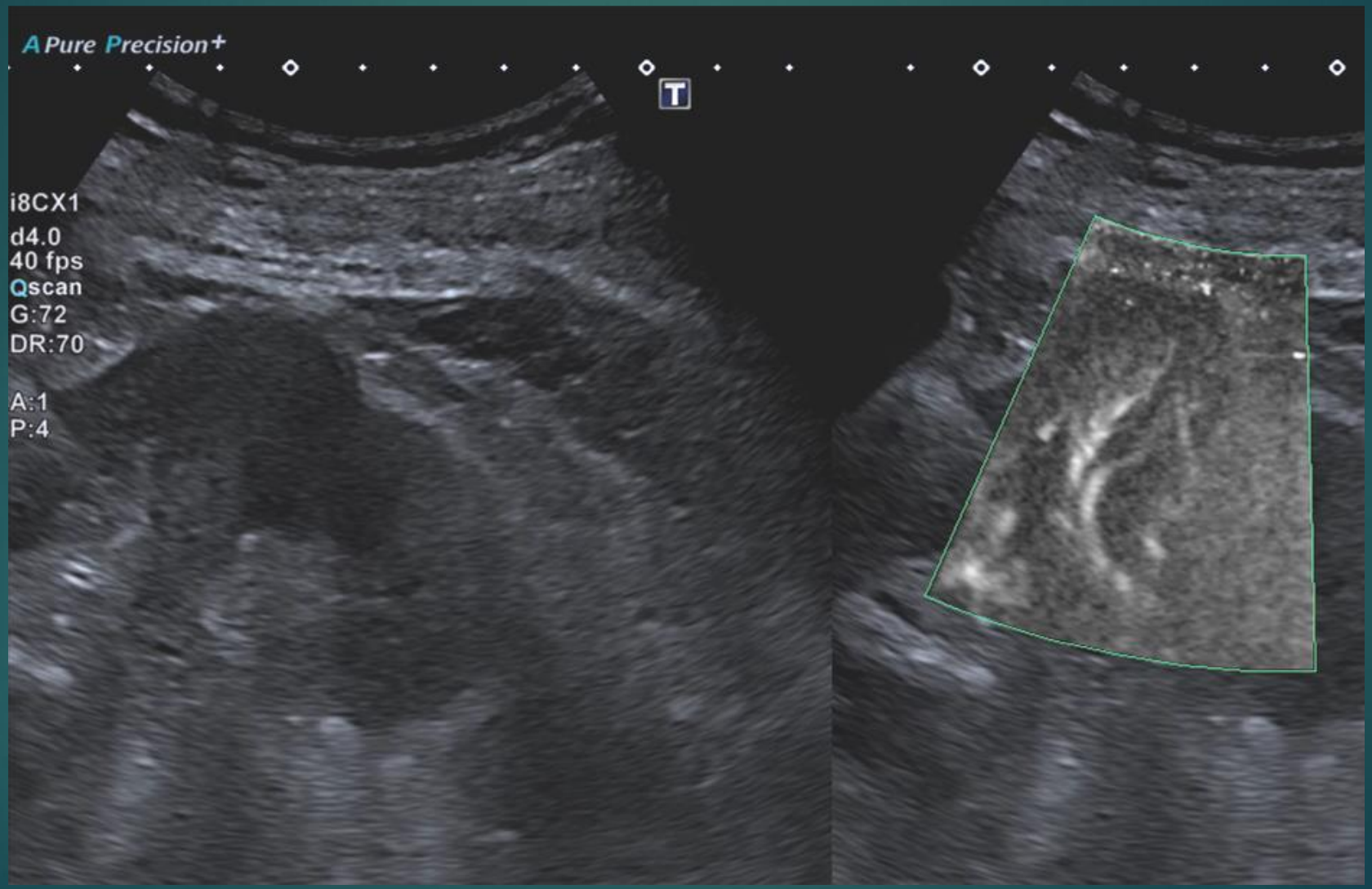


Renal Contrast Dynamics

- Kidneys 20-25% cardiac output
- Cortical phase starts 10-15 secs after injection and lasts 20-40secs followed by slower medullary phase (via vasa recta) lasting 45-120secs
- Whole exam 2 mins
- Lower dose 1-1.5ml (avoid attenuation of deeper part of kidney due to high cortical perfusion)

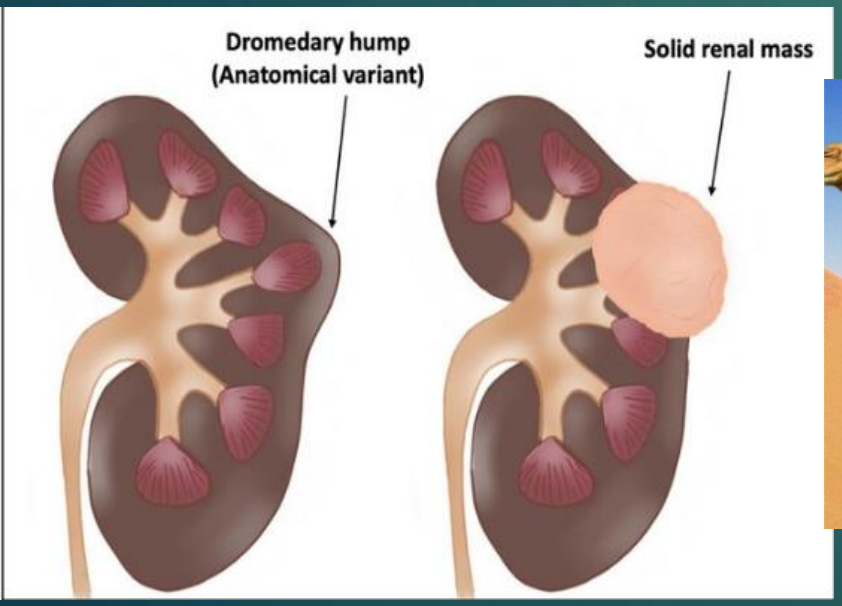

Kidney Long

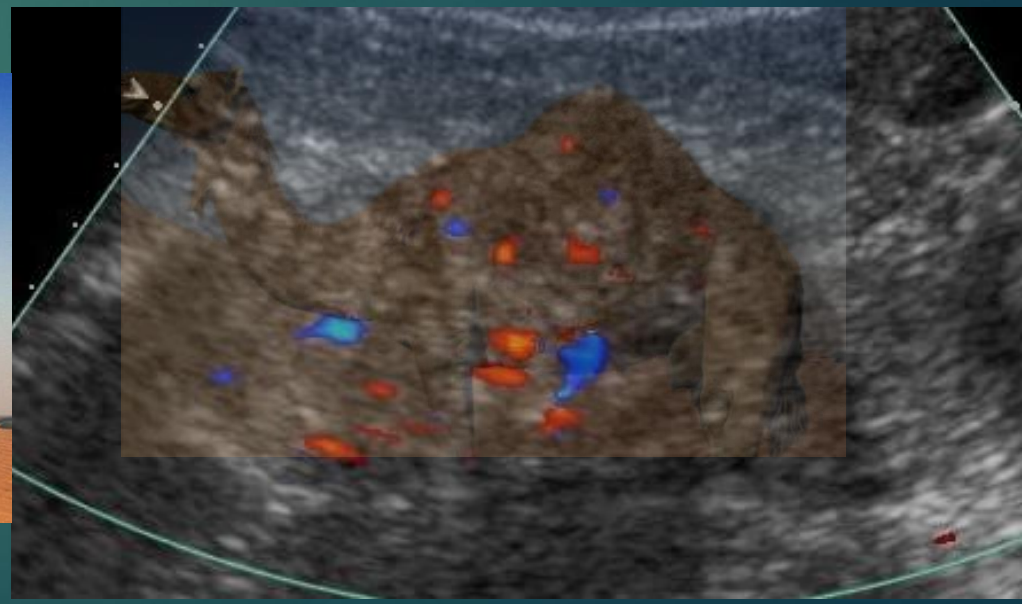
? Interpolar lesion

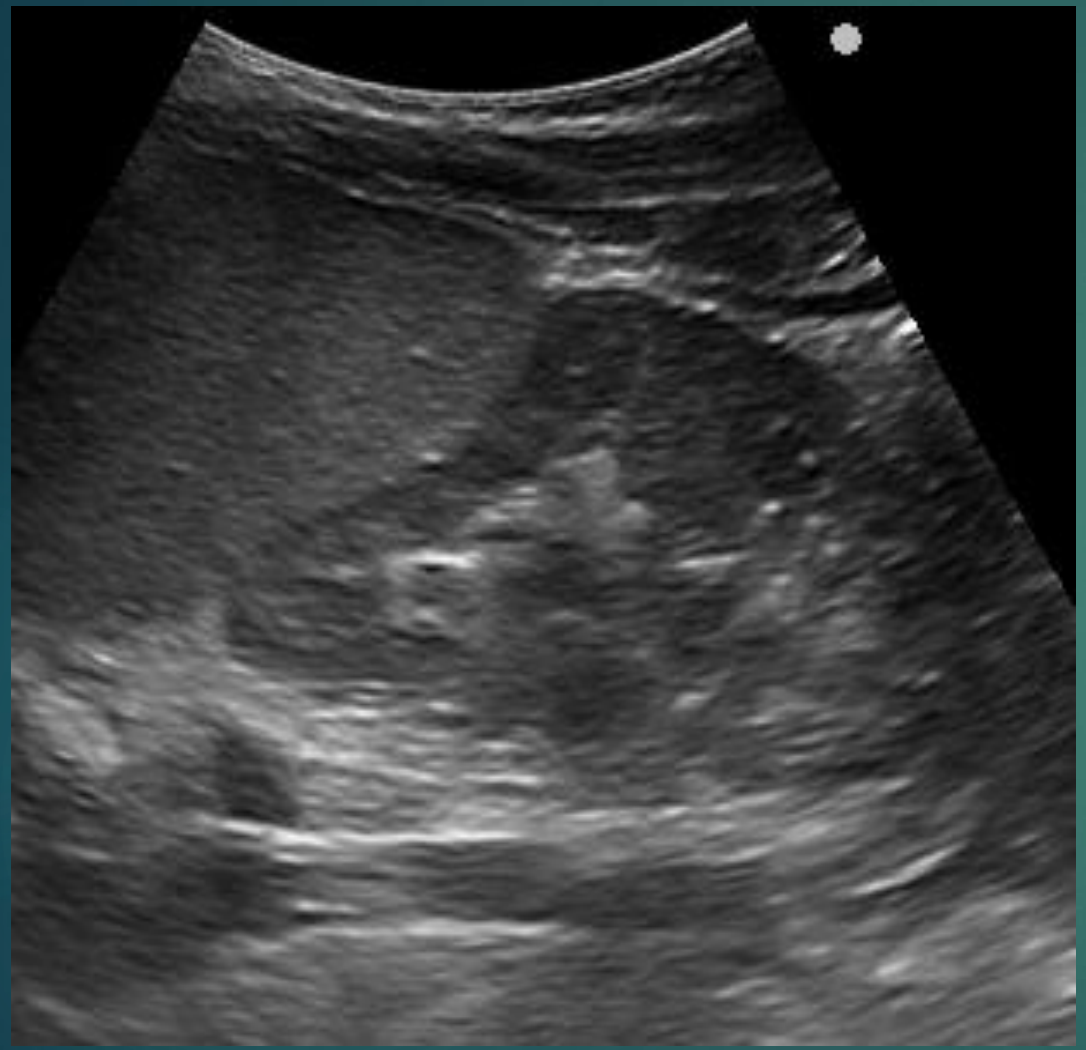


Dromedary Hump

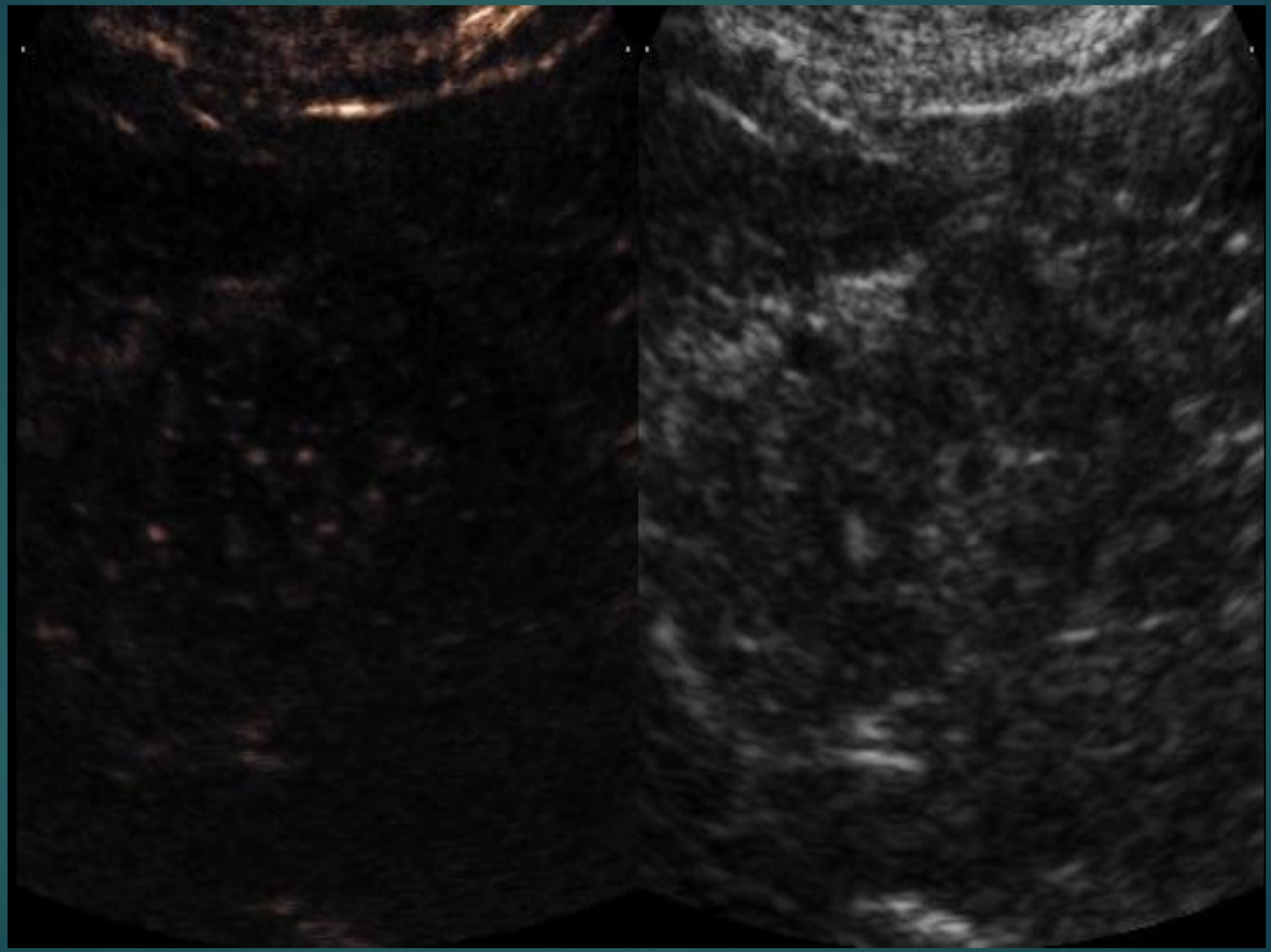
- Prominent focal bulge on the lateral border of the left kidney caused by splenic impression - mimic renal neoplasm.








Kidney Long

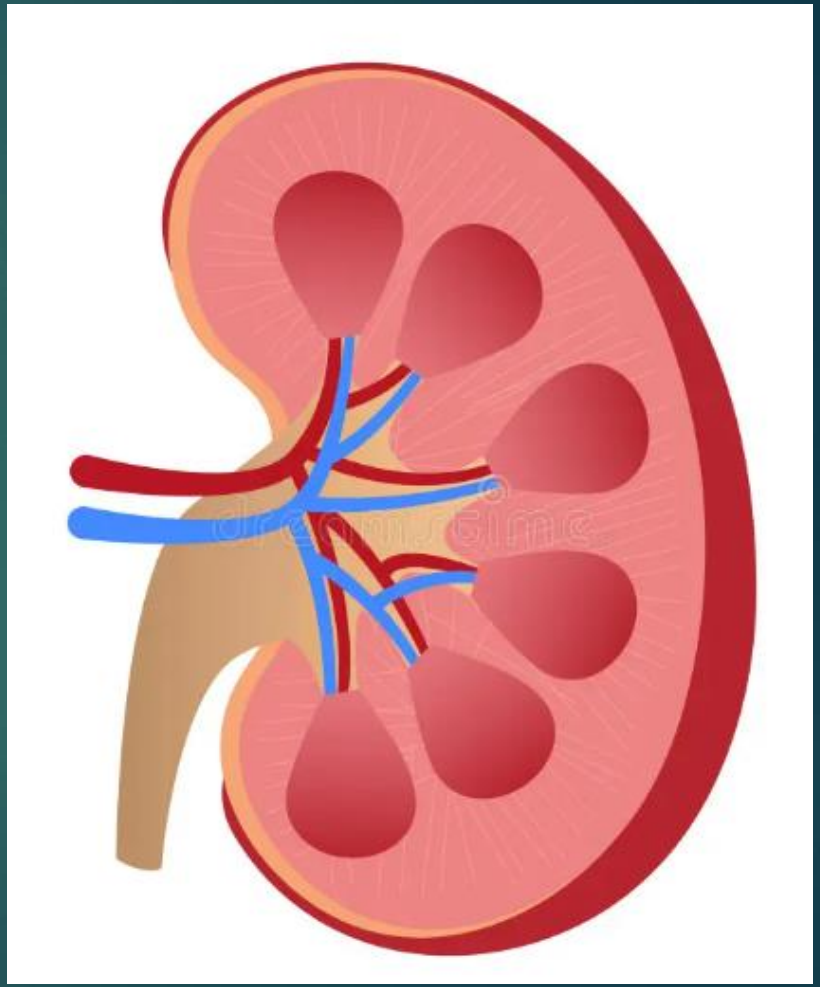


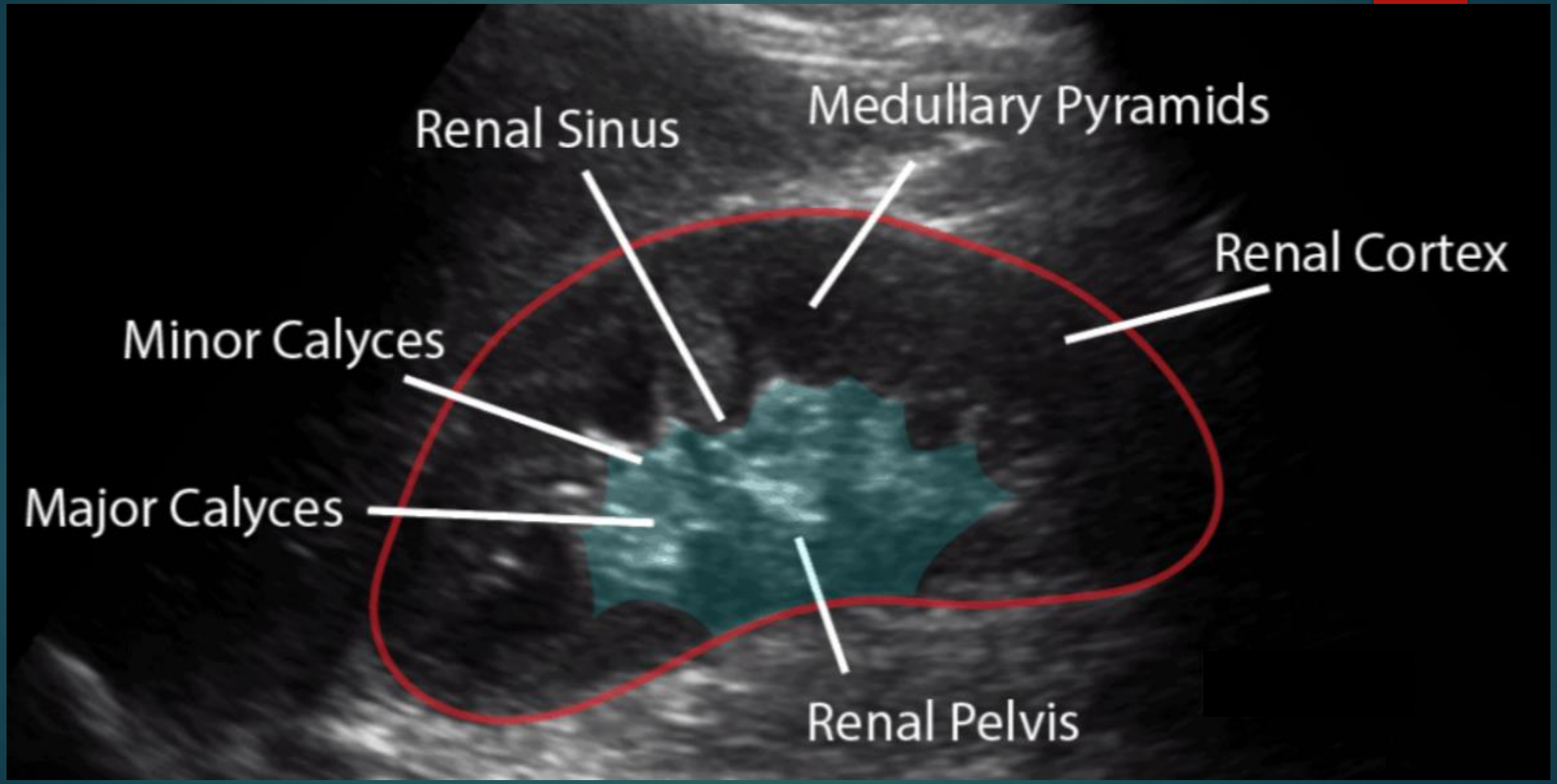
Fetal Lobulation

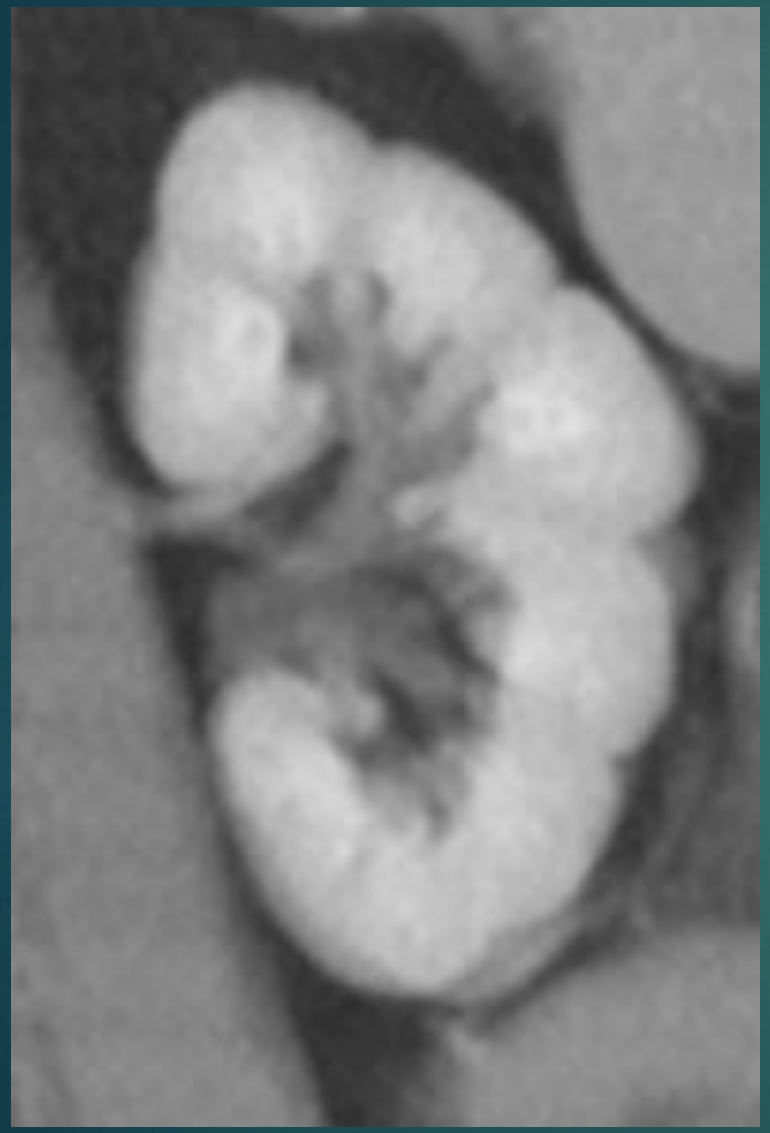
- Renal surface indentations
- Incomplete embryological fusion of developing renal lobules

- Overlie the space between the pyramids (rather than pyramids = scarring)

- Can be multiple bilateral…….. Or focal unilateral

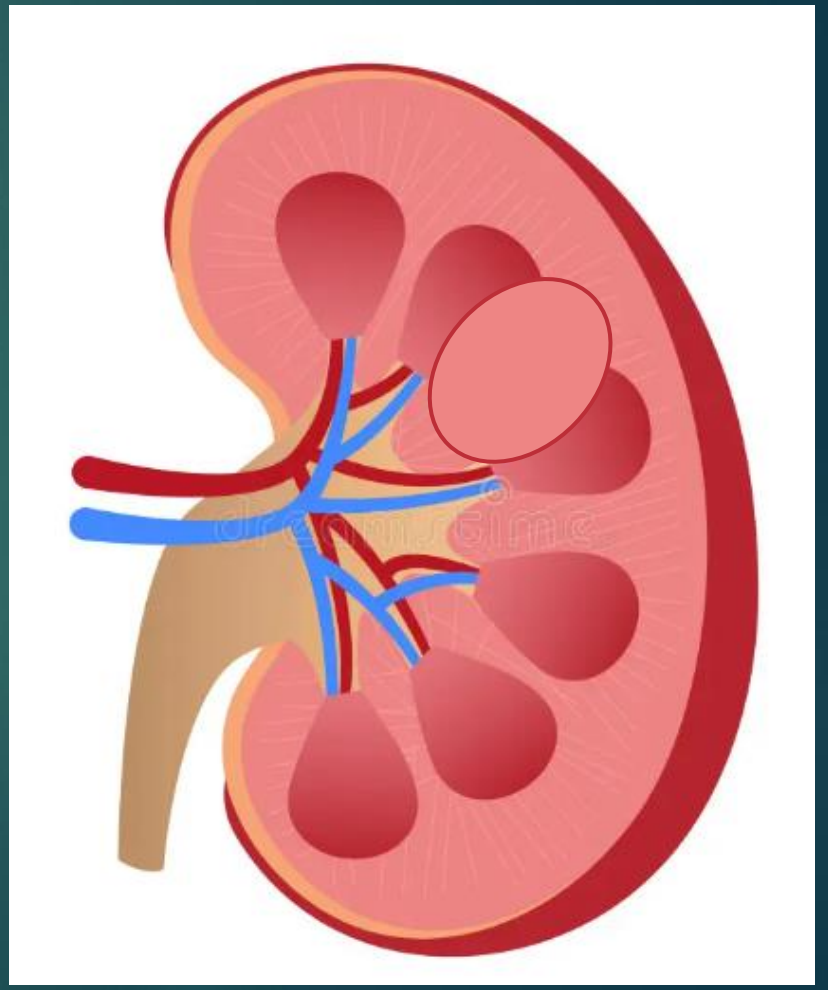


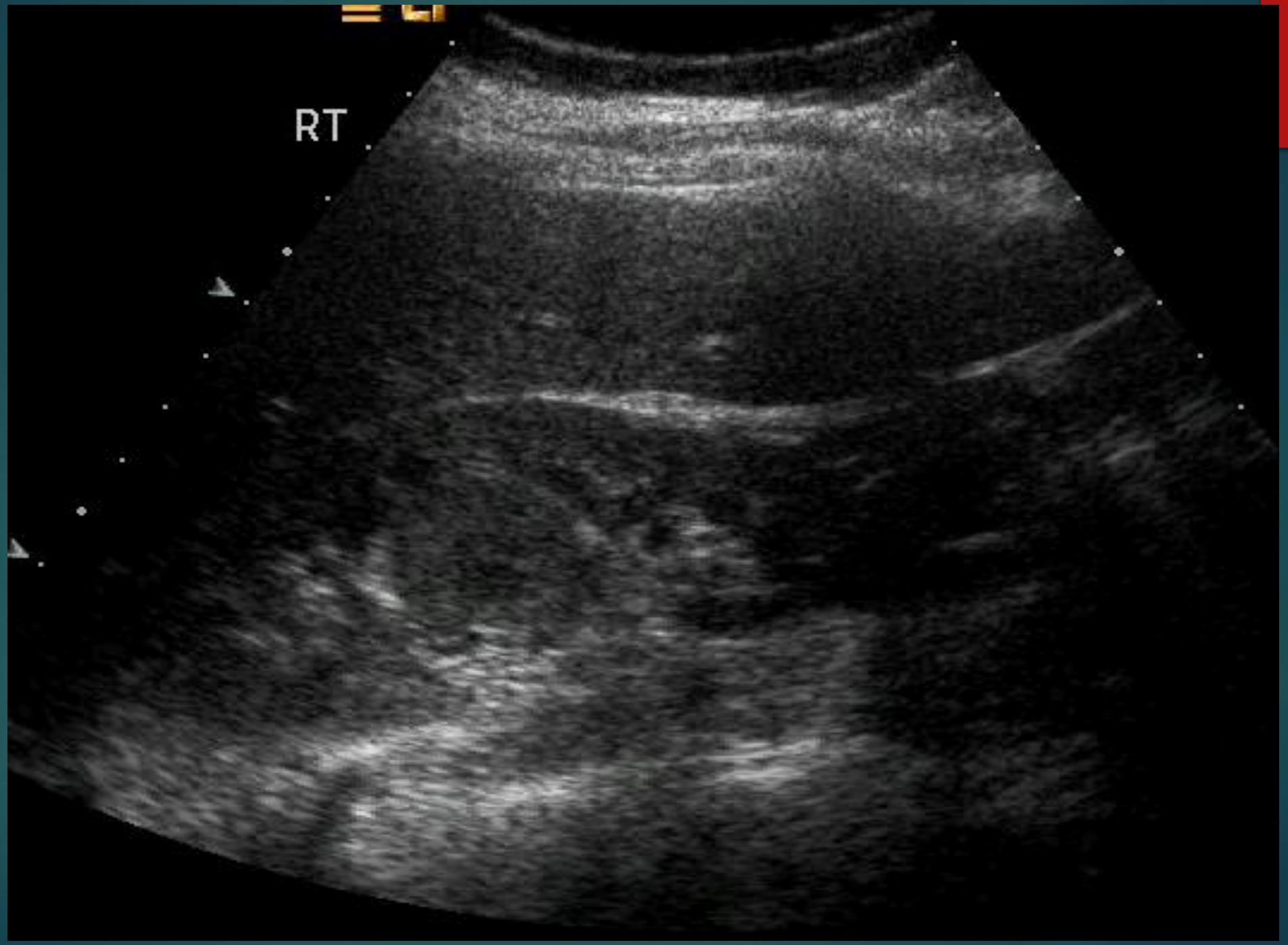

Renal Sinus
Medullary Pyramids
Renal Cortex
Minor Calyces
Major Calyces
Renal Pelvis



Hypertrophied column of Bertin

- An enlargement of the extension of renal cortical tissue which separates the pyramids
- Embyological fusion of adjacent lobules leads to cortical tissue remaining between the pyramids, each column formed by the fusion of two layers of cortex.
- In continuity with normal renal parenchyma
- Renal contour is preserved.

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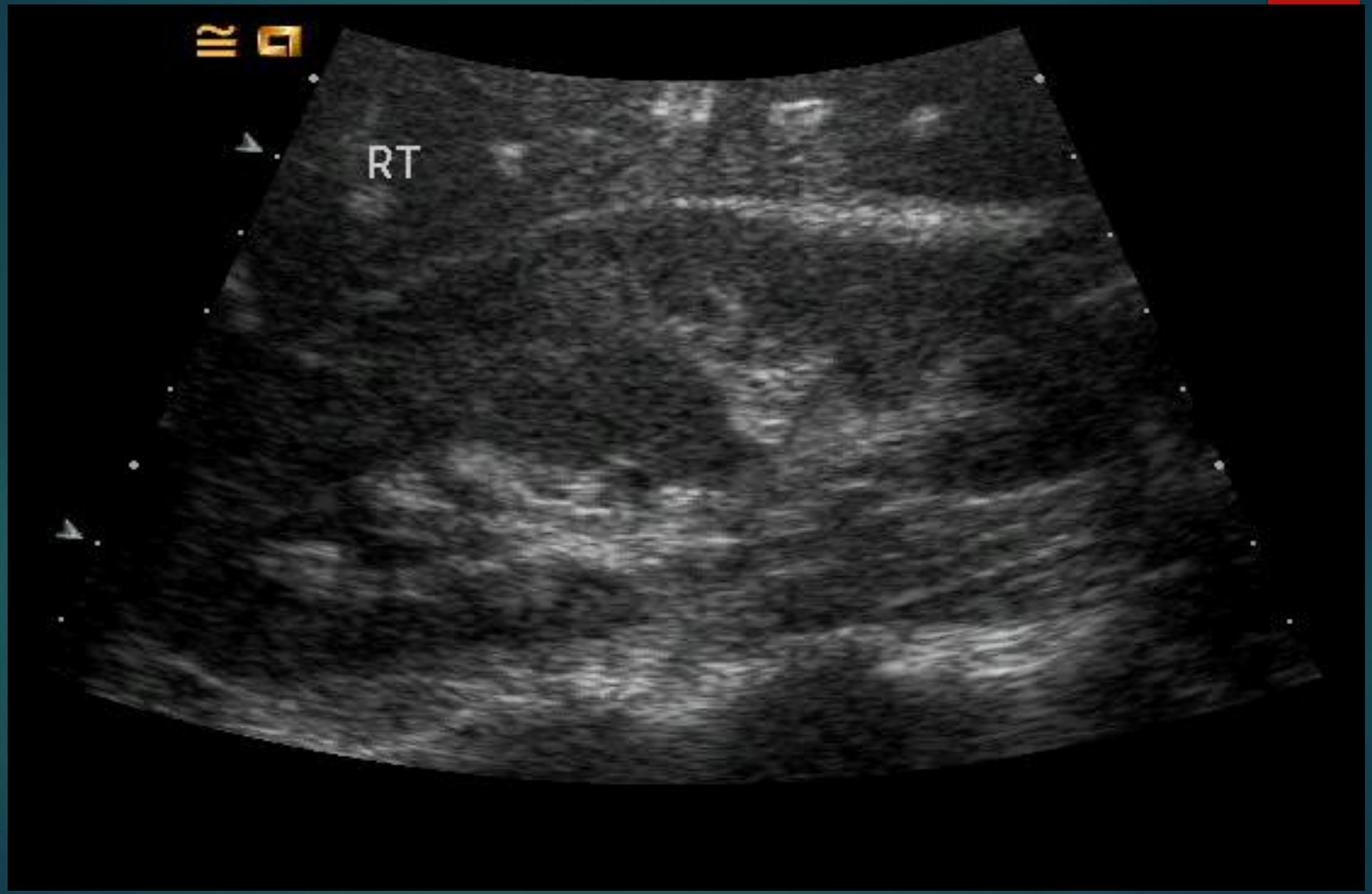
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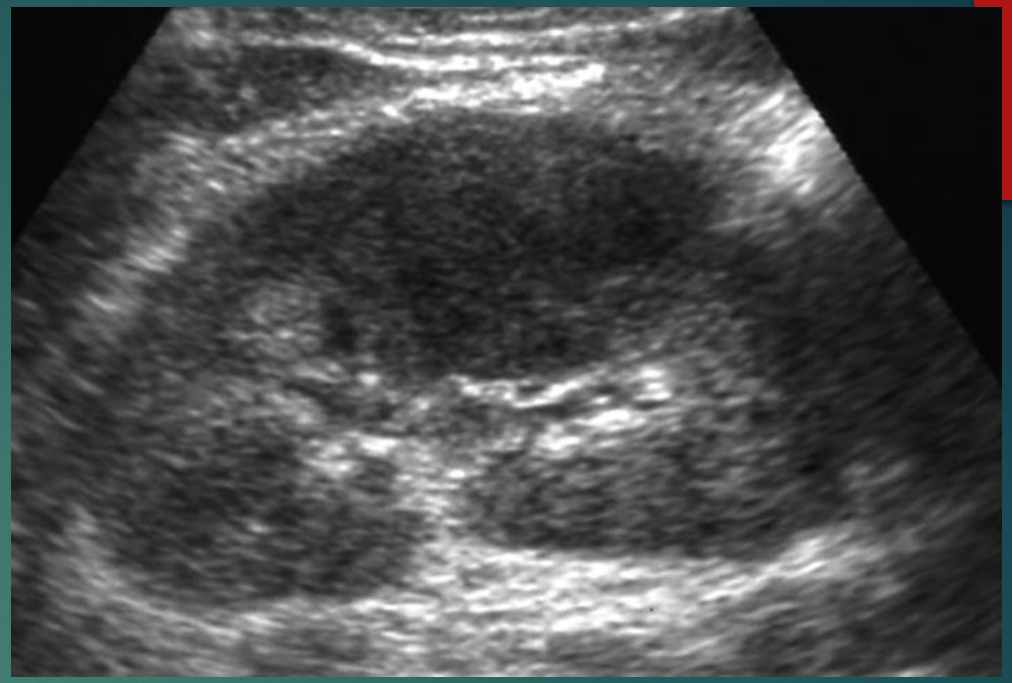
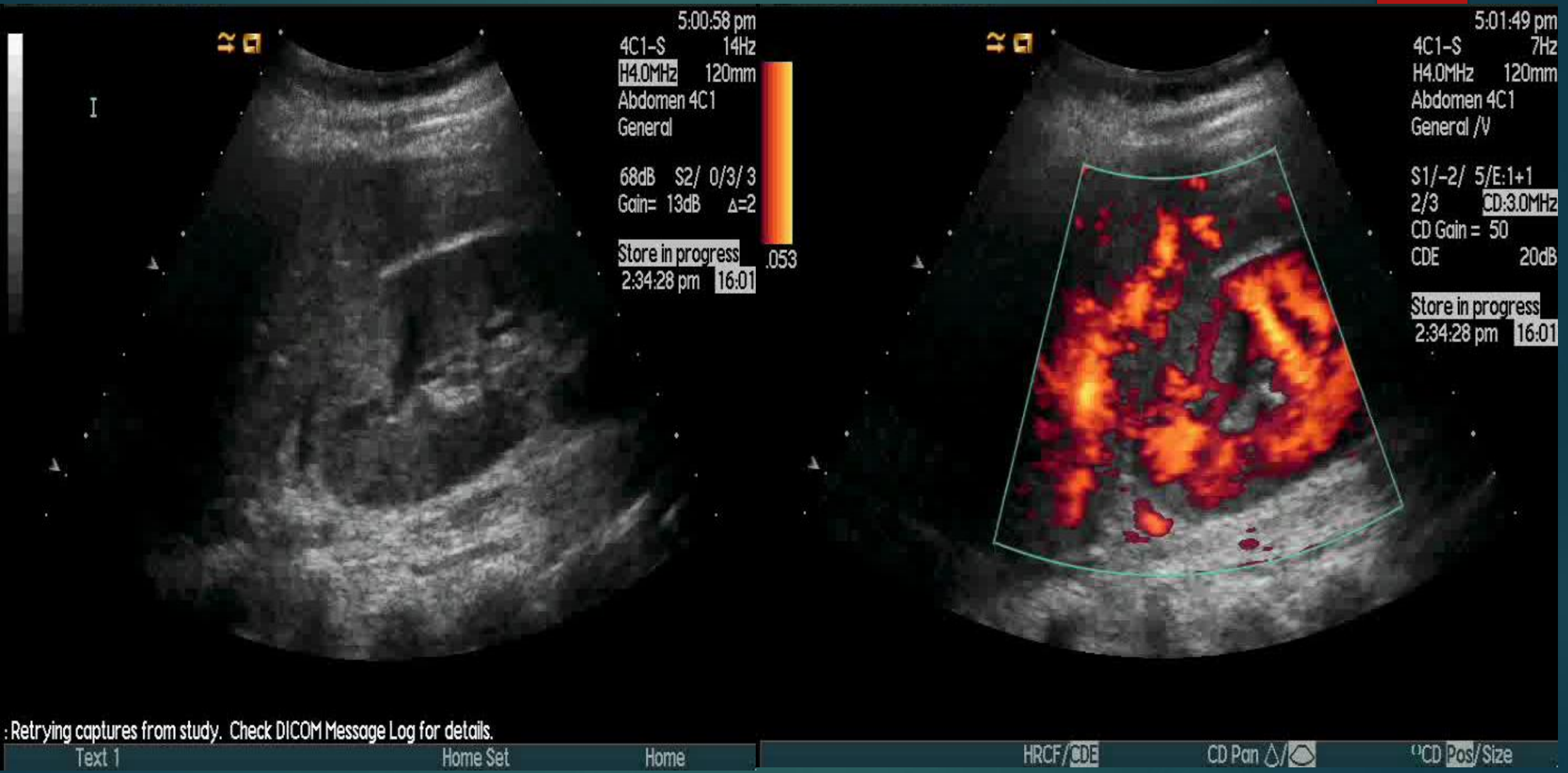
Acute Pyelonephritis

- Imaging not indicated in straightforward pyelonephritis.
- Main role of US to exclude complications & underlying anomalies
- US: Usually normal

  Enlarged kidney, low / high-reflective masses, abnormal perinephric fat, thickened urothelium, focal hypoperfusion on power Doppler.

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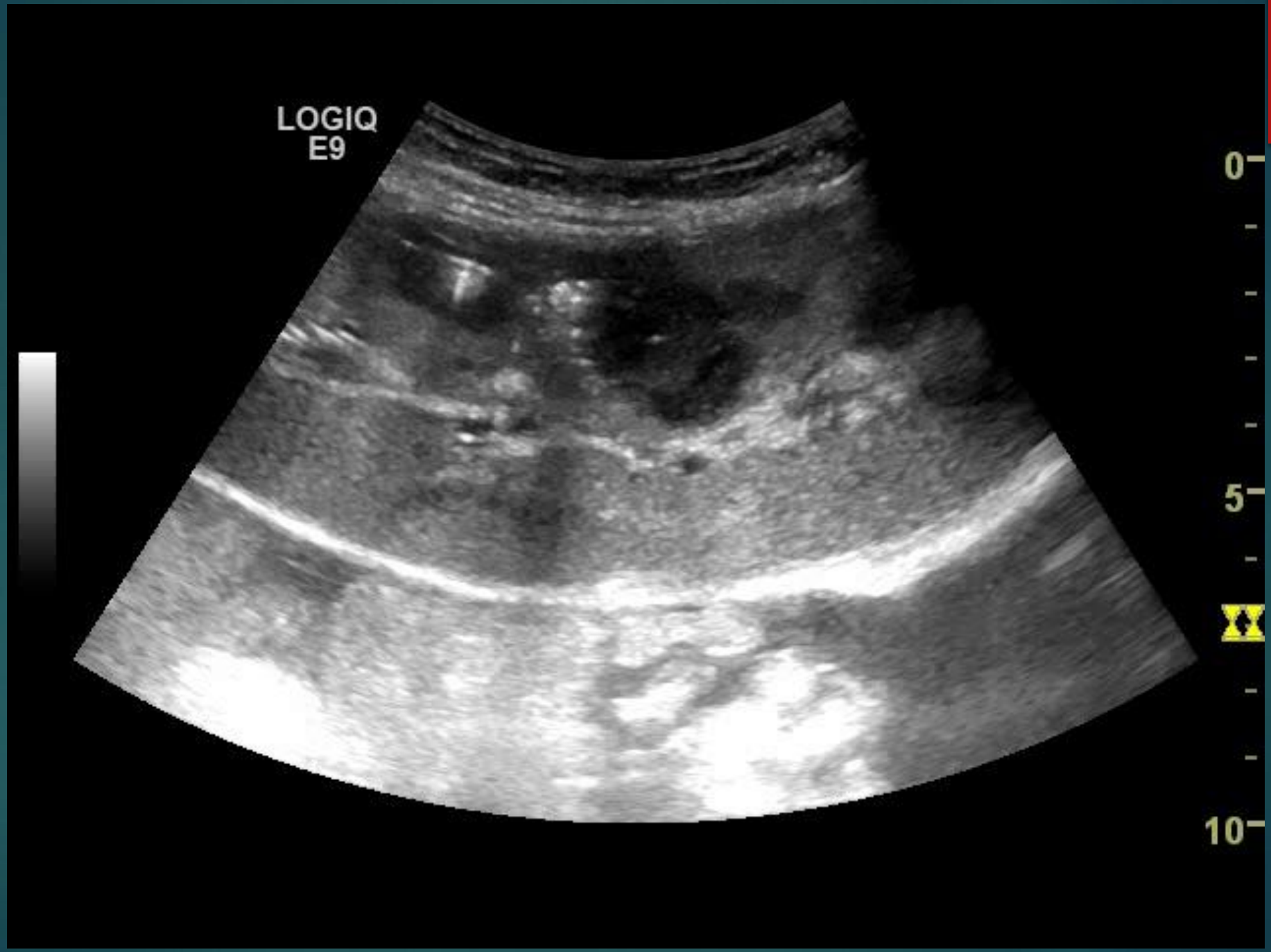
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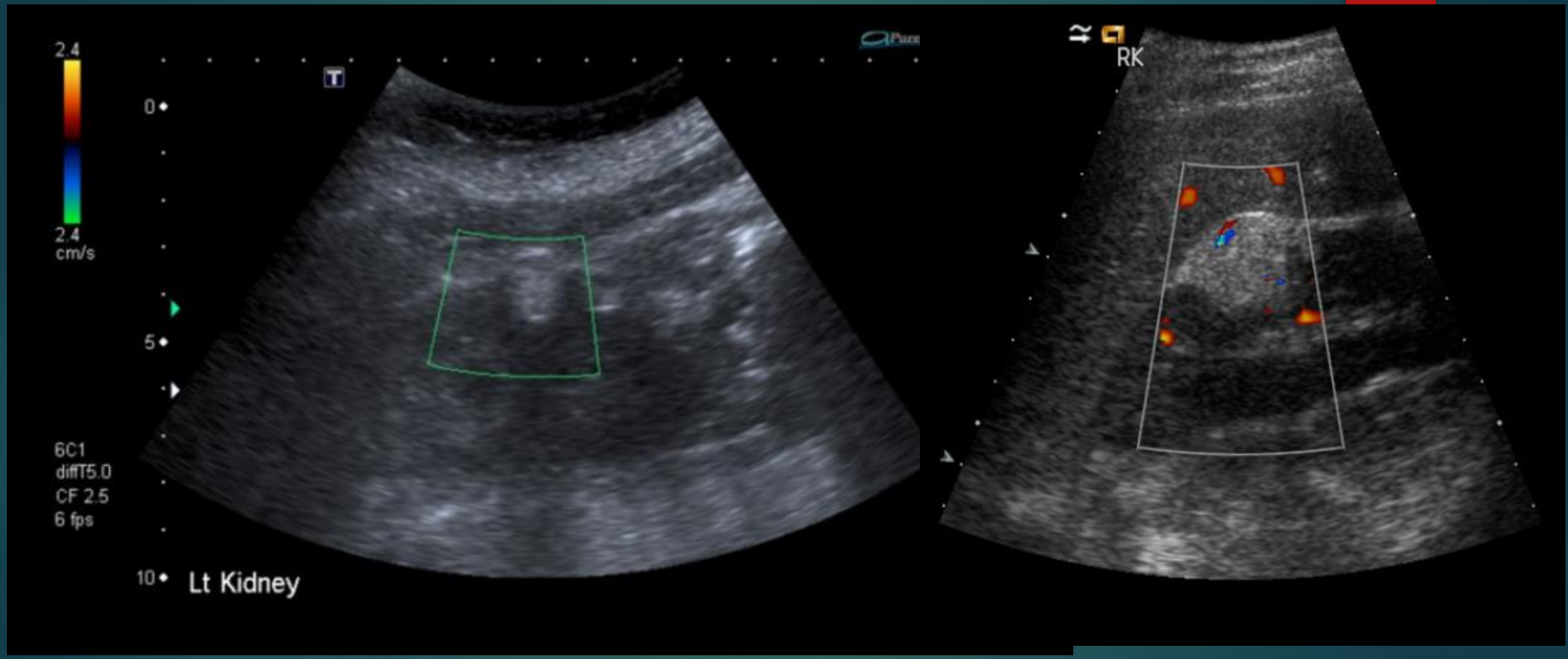
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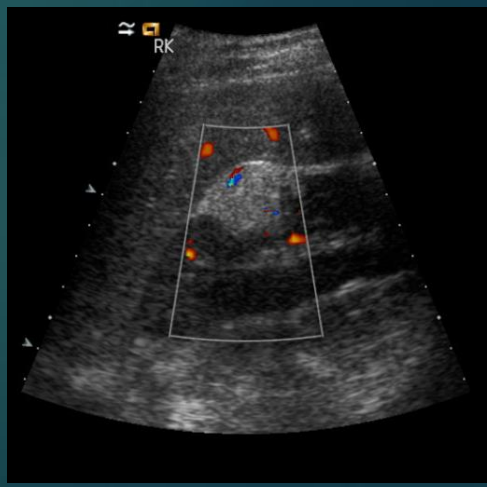
Angiomyolipoma (AML)

- The most common benign solid renal lesion
- The most common fat-containing lesion of the kidneys.

- 80% sporadic – 20% in Tuberous Sclerosis

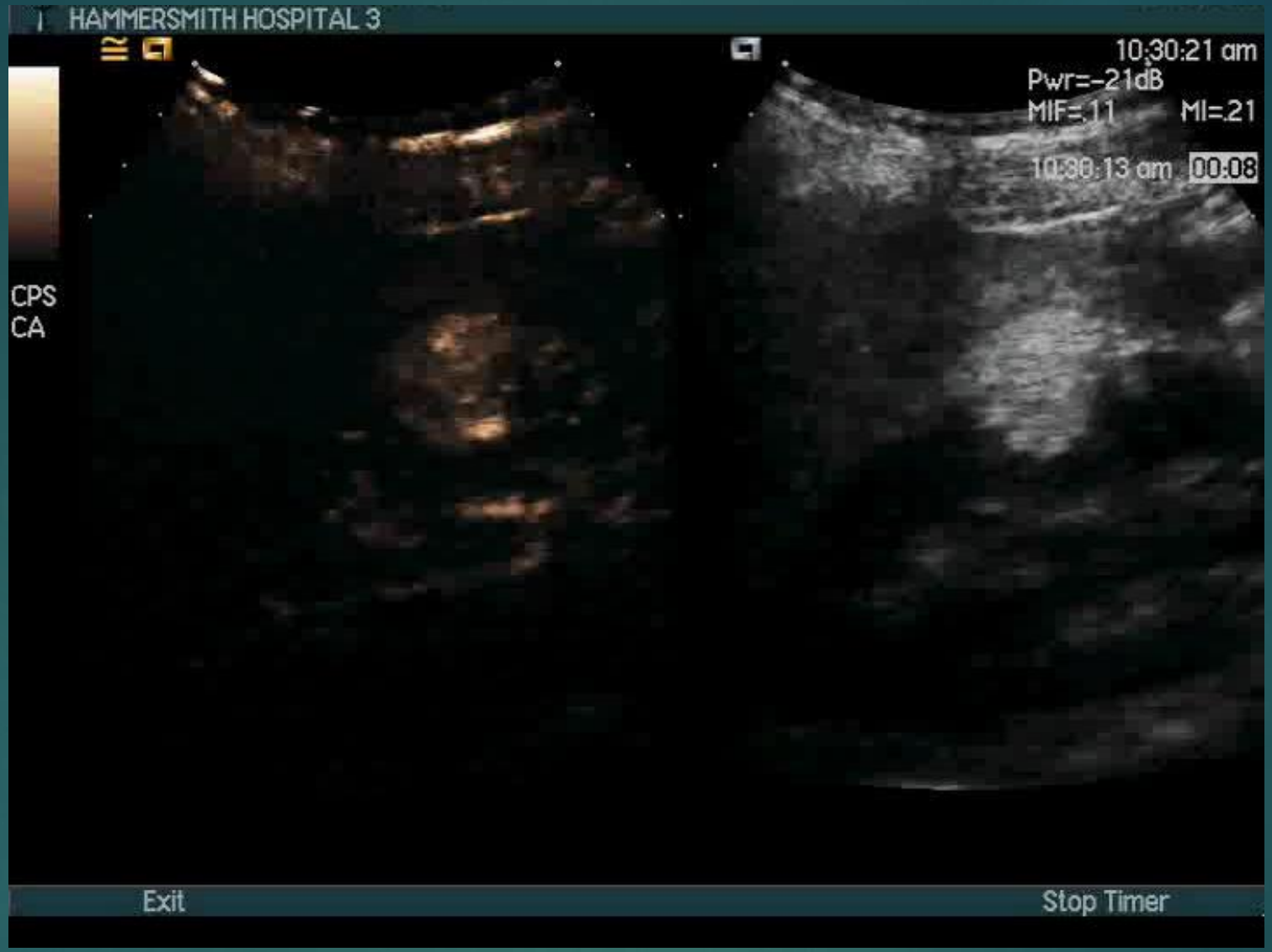
- Hyperechoic, located in the cortex and with beam attenuation posteriorly (as seen in fatty liver)



- Can grow in pregnancy (F:M = 2-4:1)

- Risk of rupture >4cm

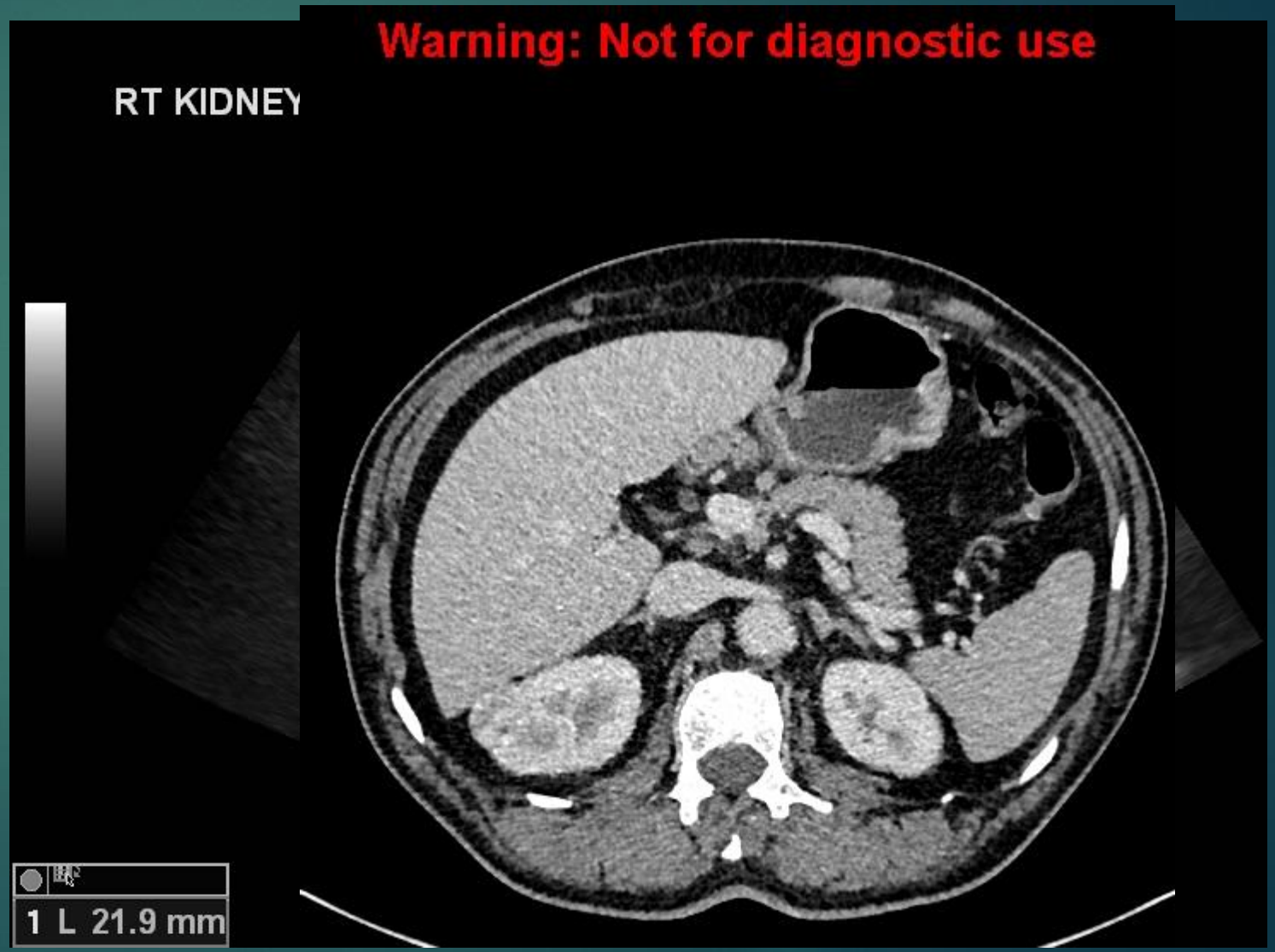
- Observation (6-12 months) / embolization / renal sparing surgery



- Tend to enhance peripherally with decreased central enhancement, compared with normal cortex

Echogenic Renal lesions

- RCC (1/3)
  - Hypoechoic rim
  - Calcification
  - Cystic areas
- Lipoma / liposarcoma
- Oncocytoma



Oncocytoma

- Benign Tumour. 3-7% of all solid renal tumours
- Difficult to distinguish from renal cell carcinoma in the preoperative setting.
  - 6-7th Decade
  - M:F = 2:1
- Can be hyper/iso/hypoechoic…. +/- central scar (up to 33% - size dependent)
- Some overlap between RCC, AML and oncocytoma – incl CEUS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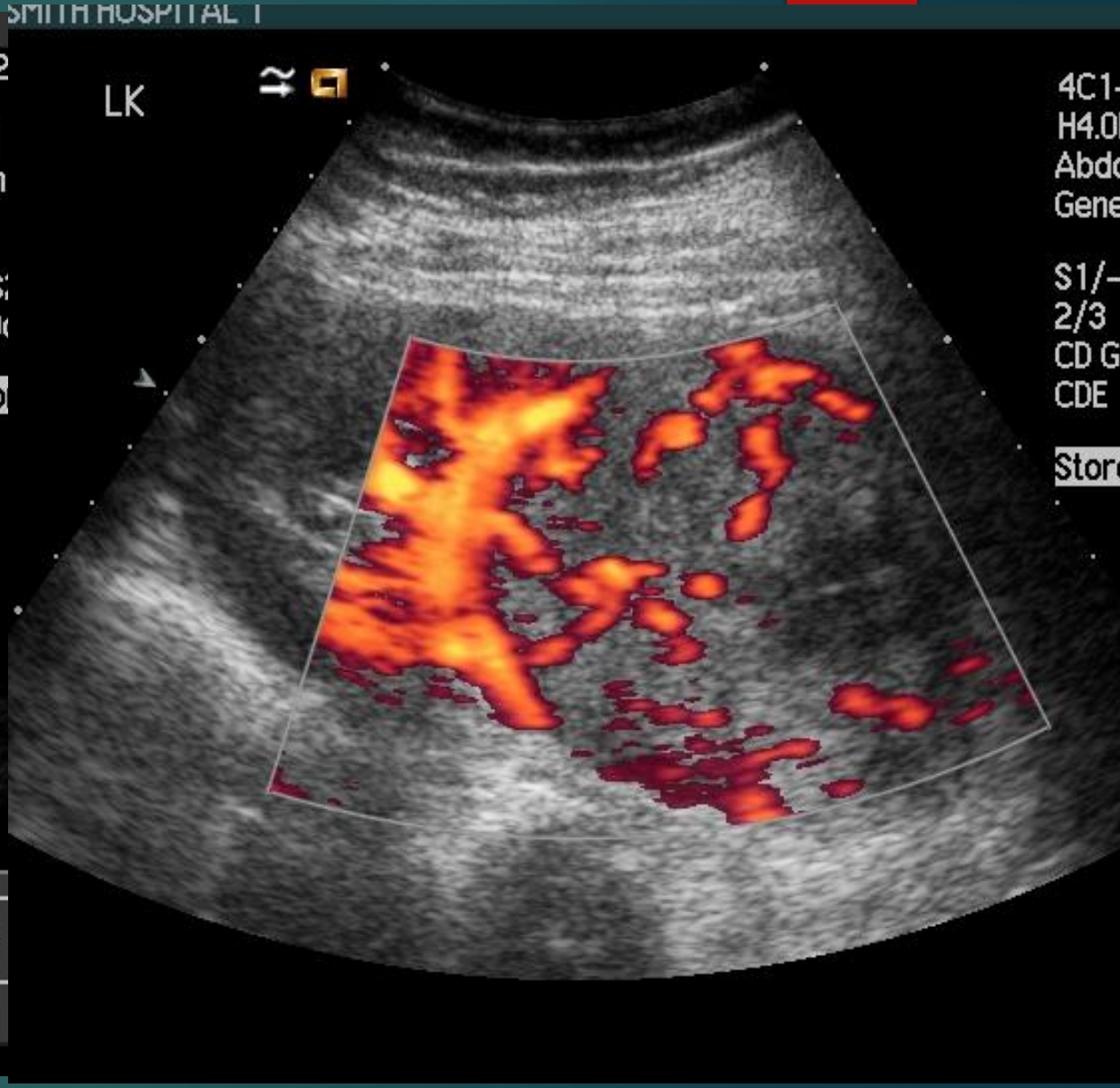
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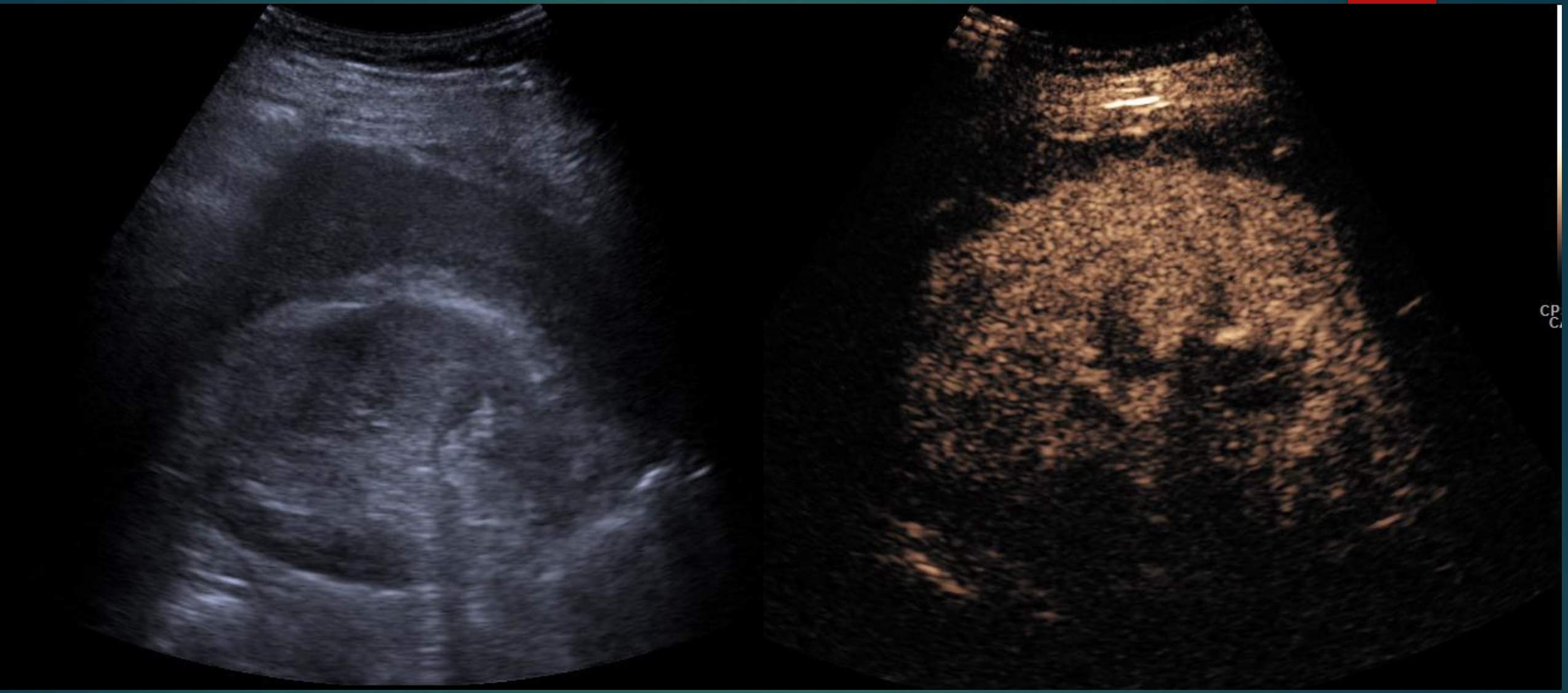
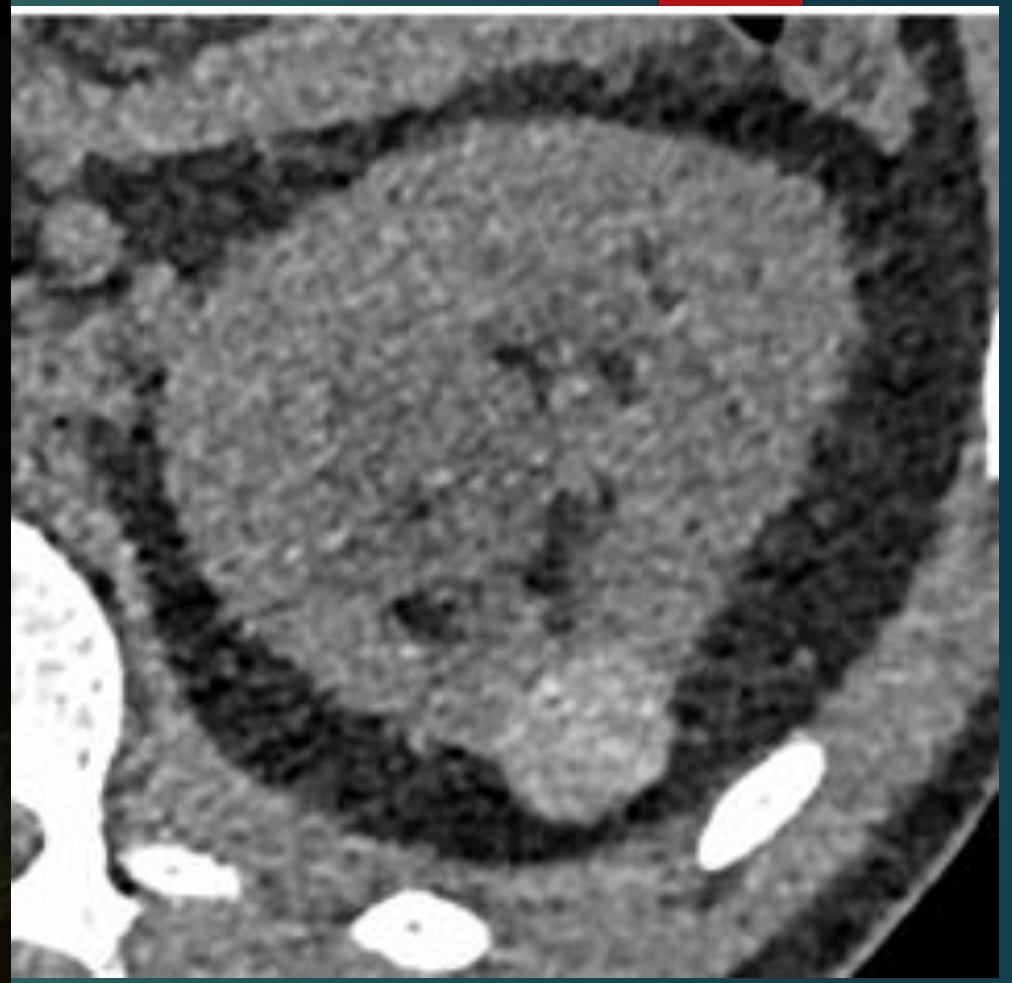


Cyst vs Solid

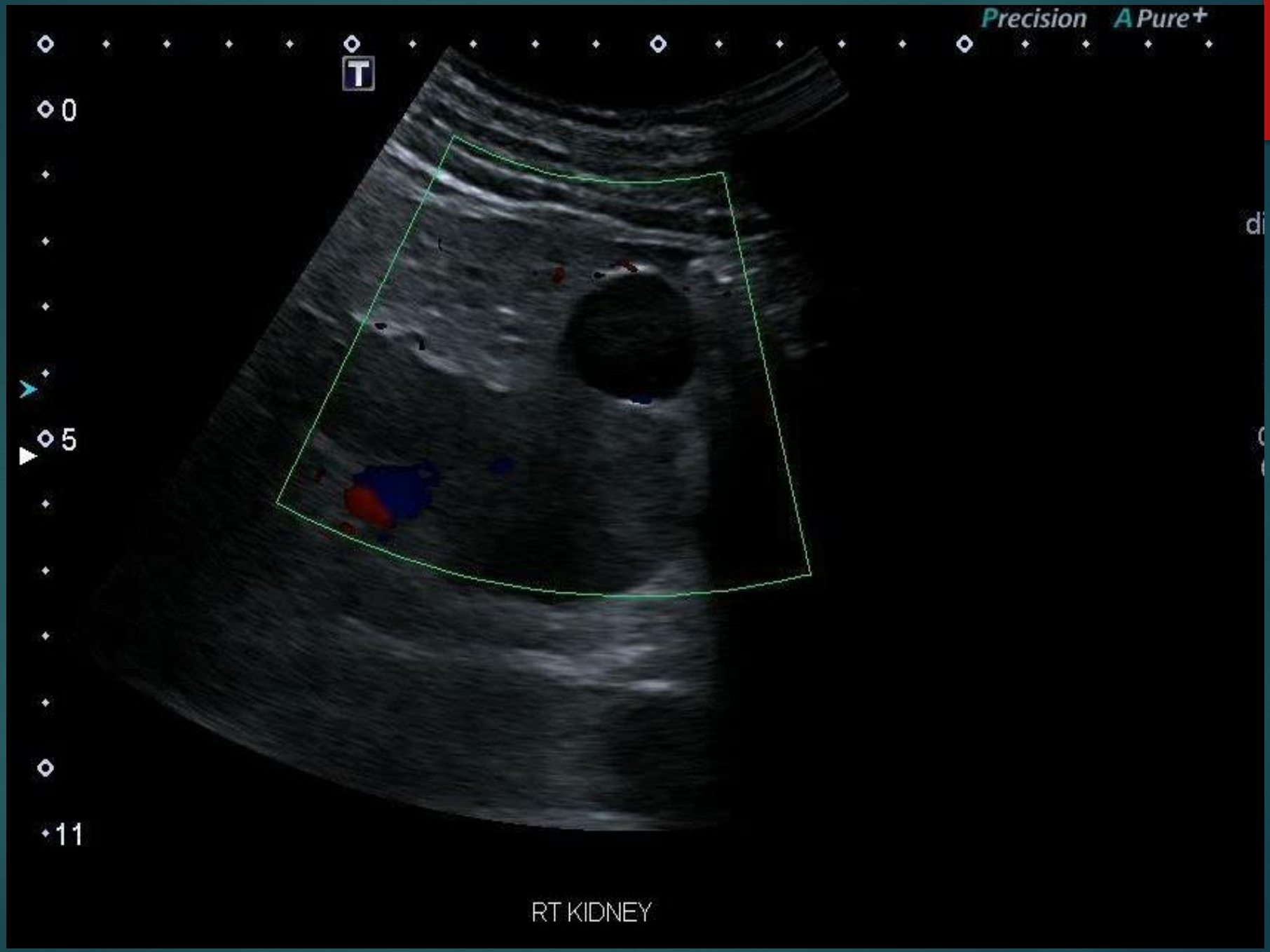
- Thin-walled
- Anechoic
- Avascular
- Posterior acoustic enhancement

- Incidental finding on US
- Assessment of the suspected hyperdense cyst on CT

- No further follow up required



Cyst vs Solid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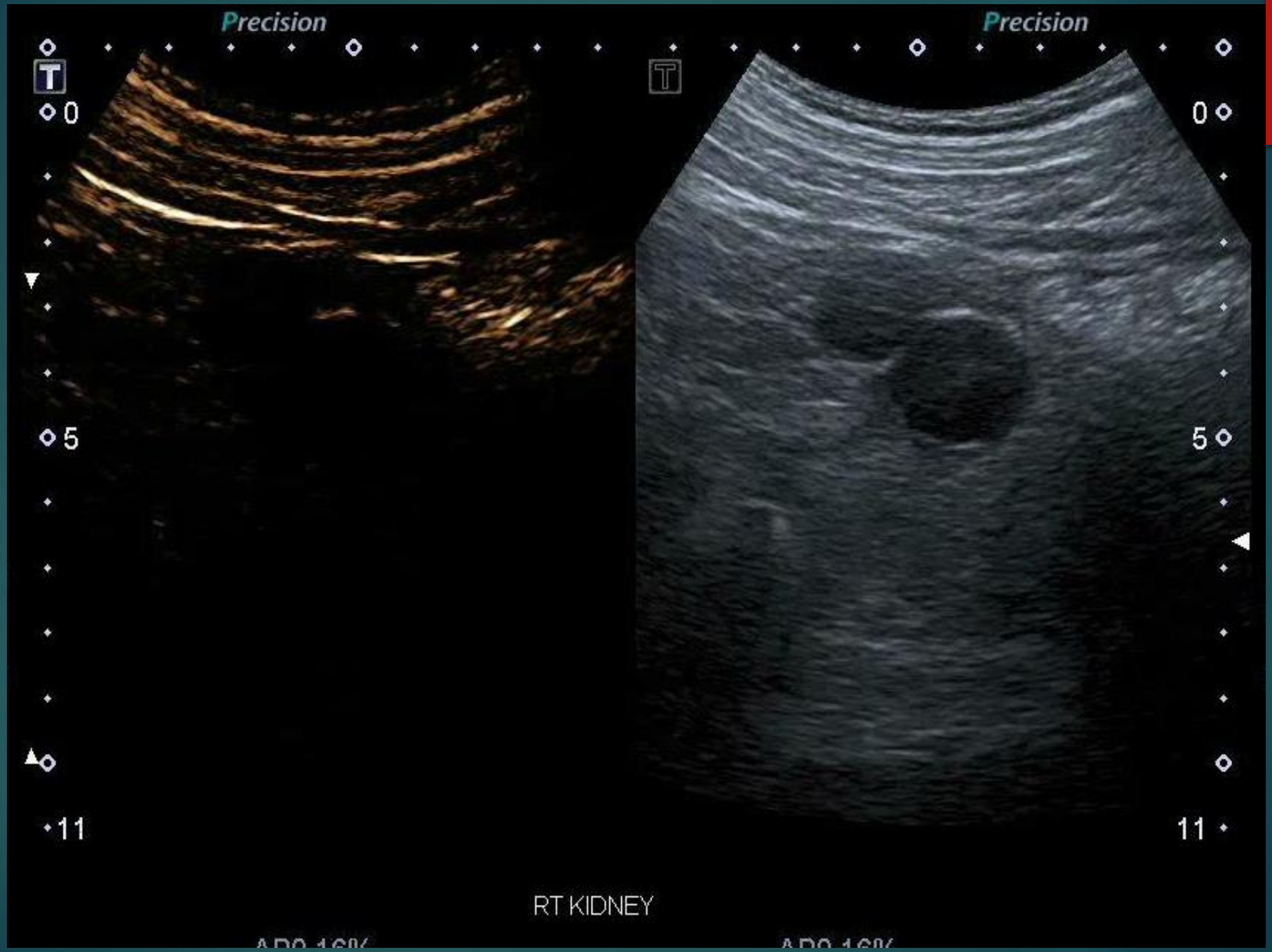
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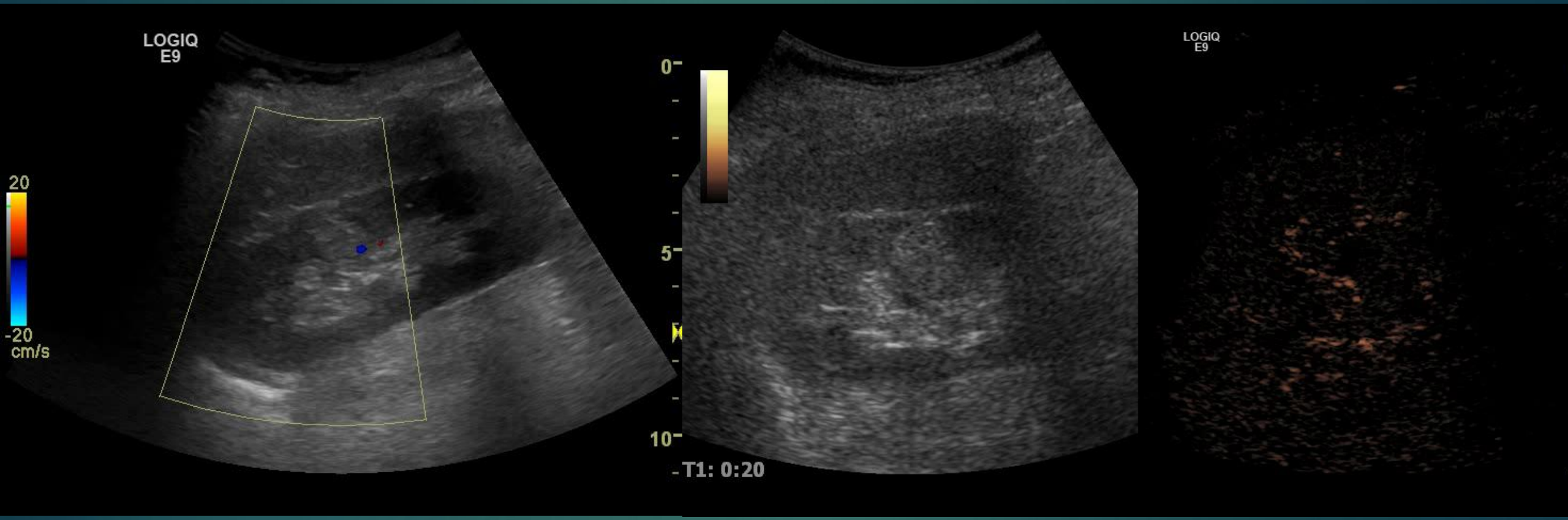
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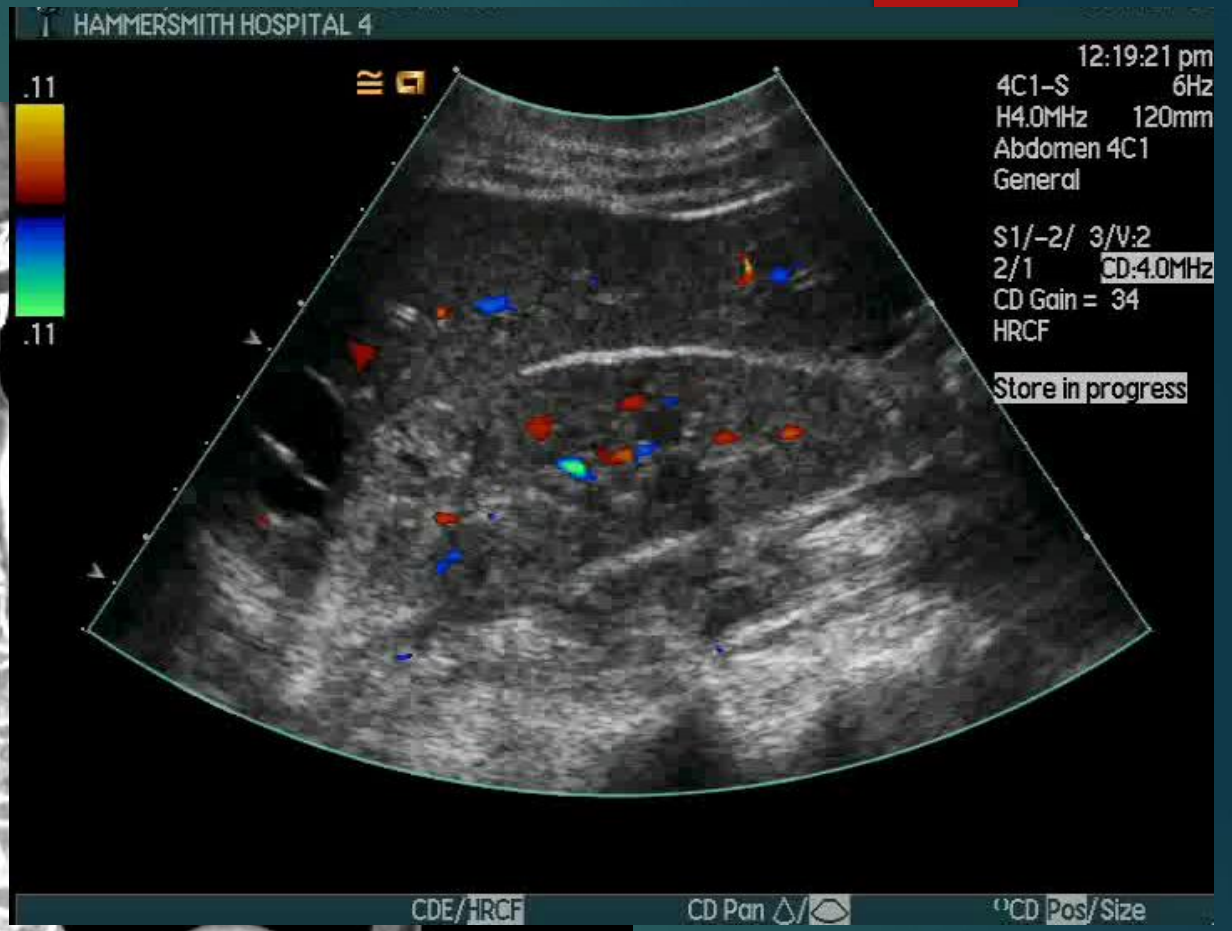
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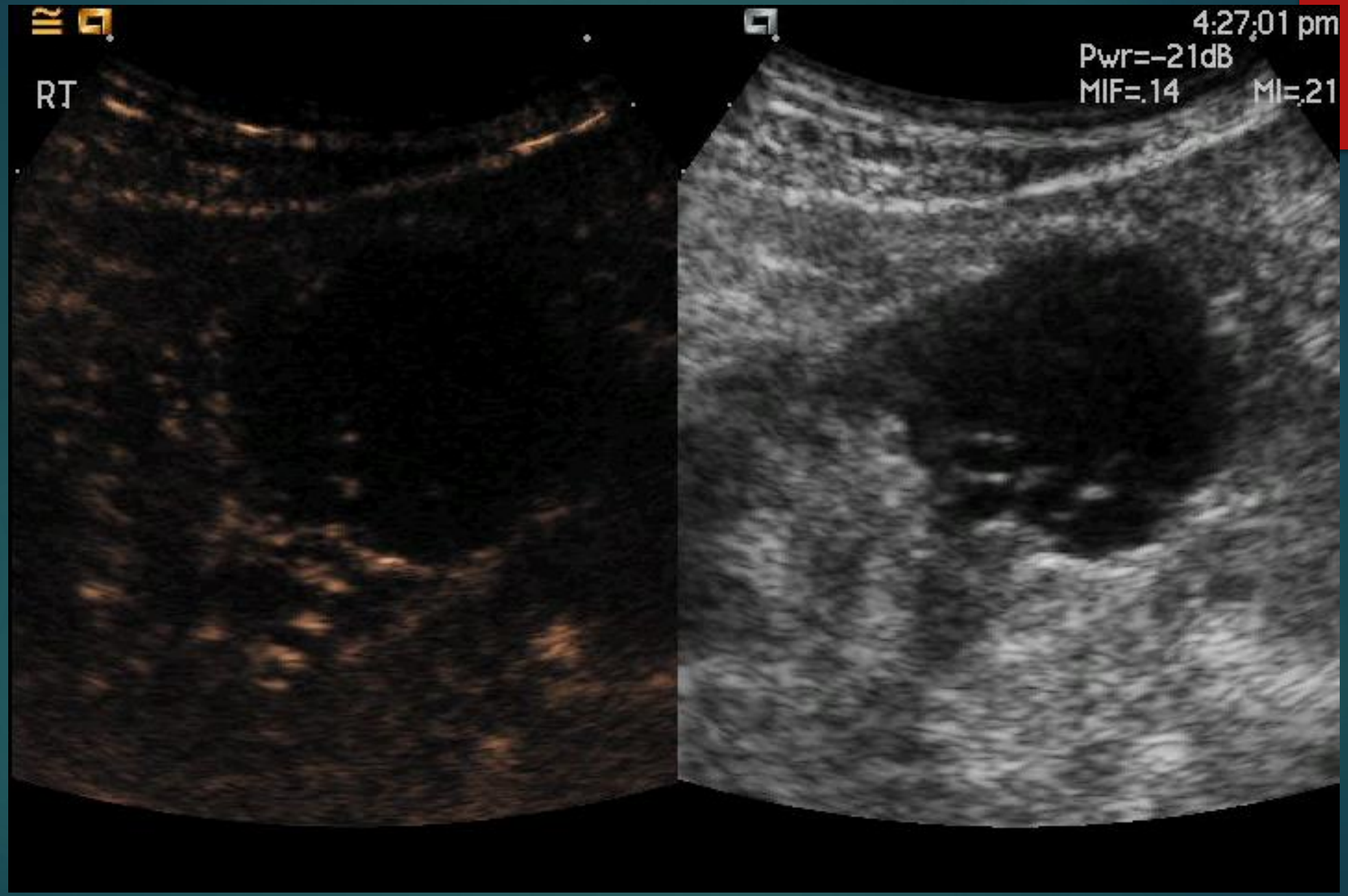
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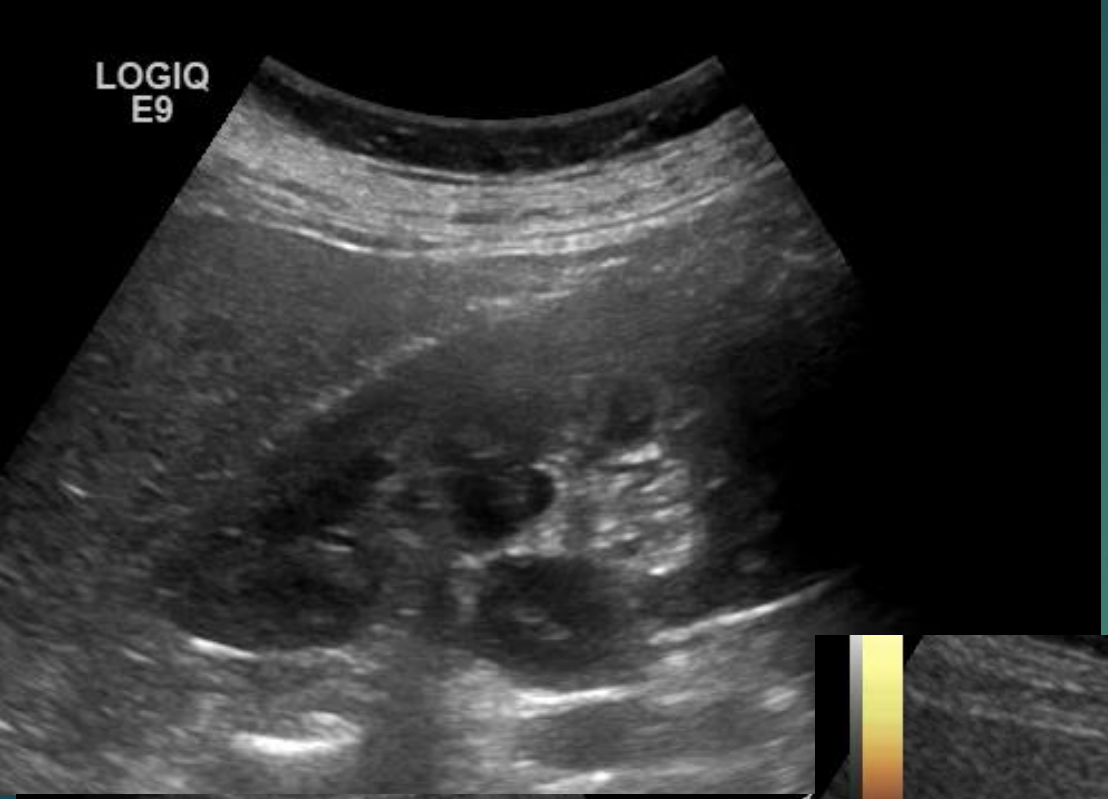
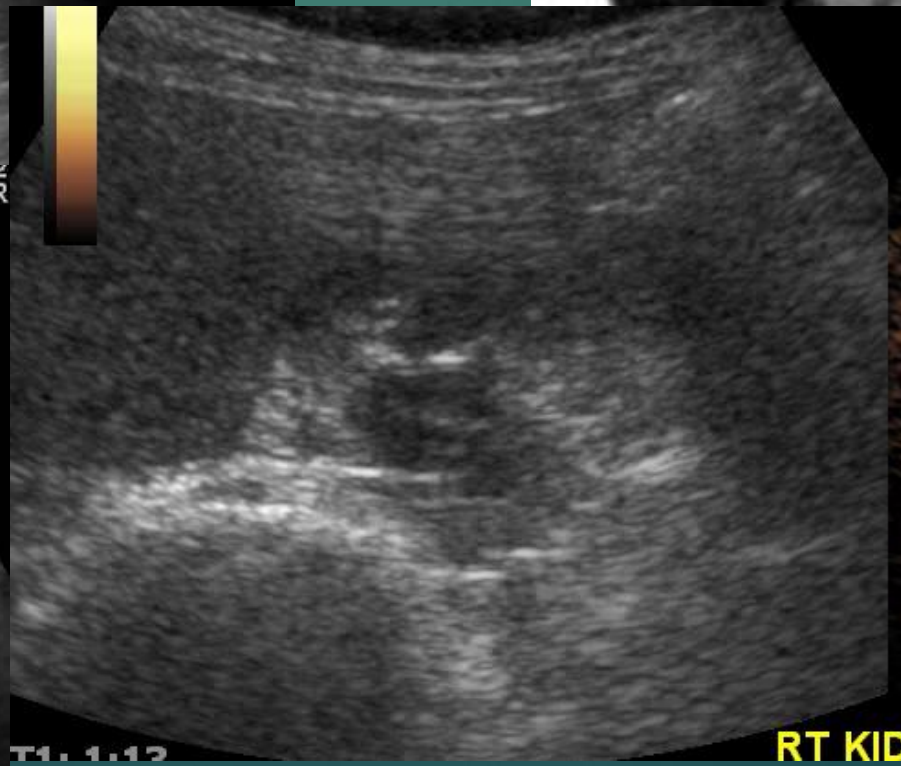
UCC/TCC

- The most common primary malignancy of the urinary tract - found along its entire length, from renal pelvis to bladder.
- Older Males
- Smoking + Industrial chemical exposure
- Horseshoe kidney and calculi
- Haematuria, Pain (hydronephrosis)
- Bladder 97%

UCC / TCC

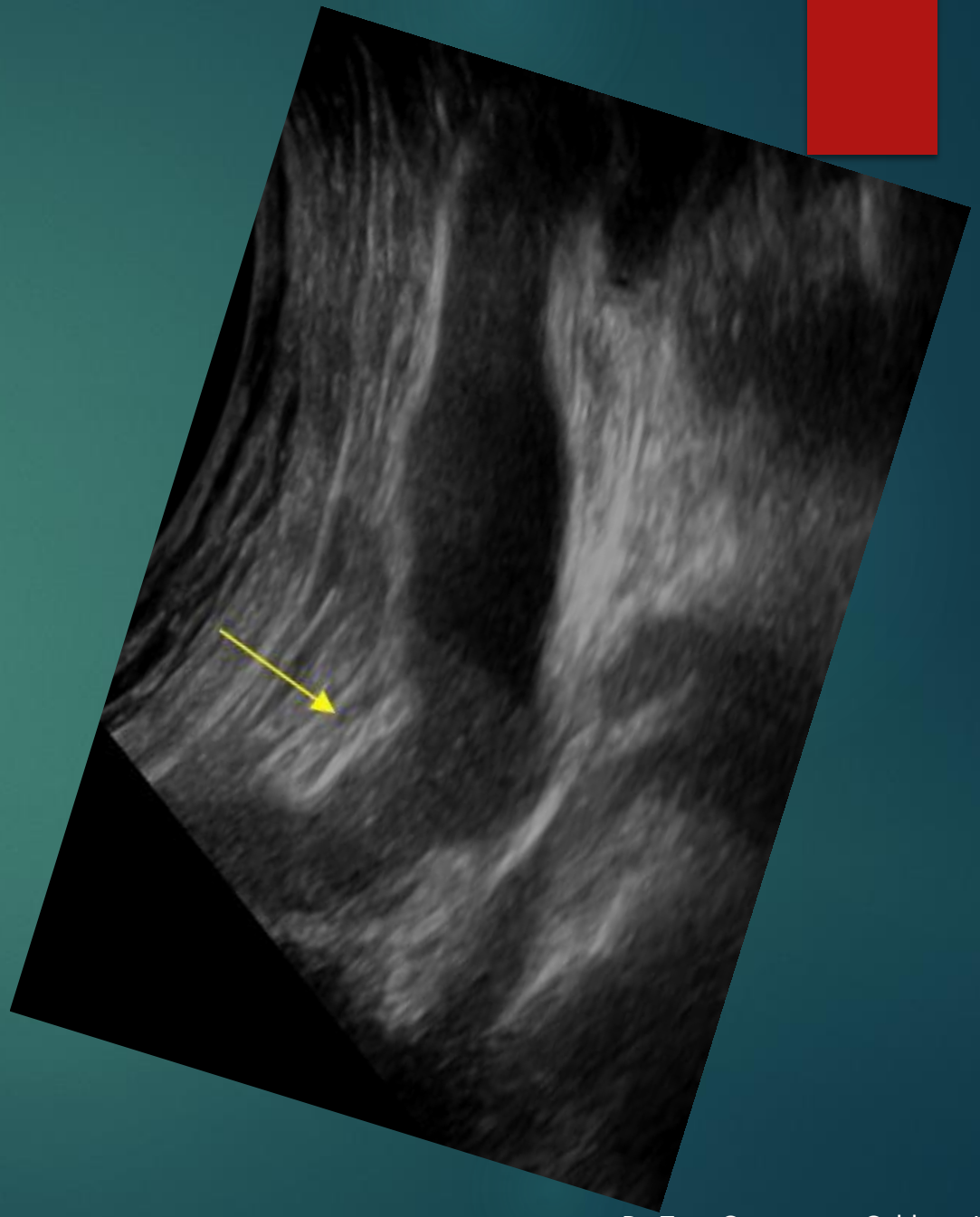
- May be seen as a hyperechoic mass, often centrally located, with subtle posterior acoustic shadowing.
- Similar reflectivity to sinus fat.
- + /- hydronephrosis / dilated calyx
- Typically infiltrative and do not cause renal contour distortion
- Differential includes blood clots, sloughed papilla, or fungus ball
- Small non-obstructing TCCs may be impossible to visualize.





Dr. Taco Geertsma – Gelderse Vallei Hospital

UCC/TCC elsewhere



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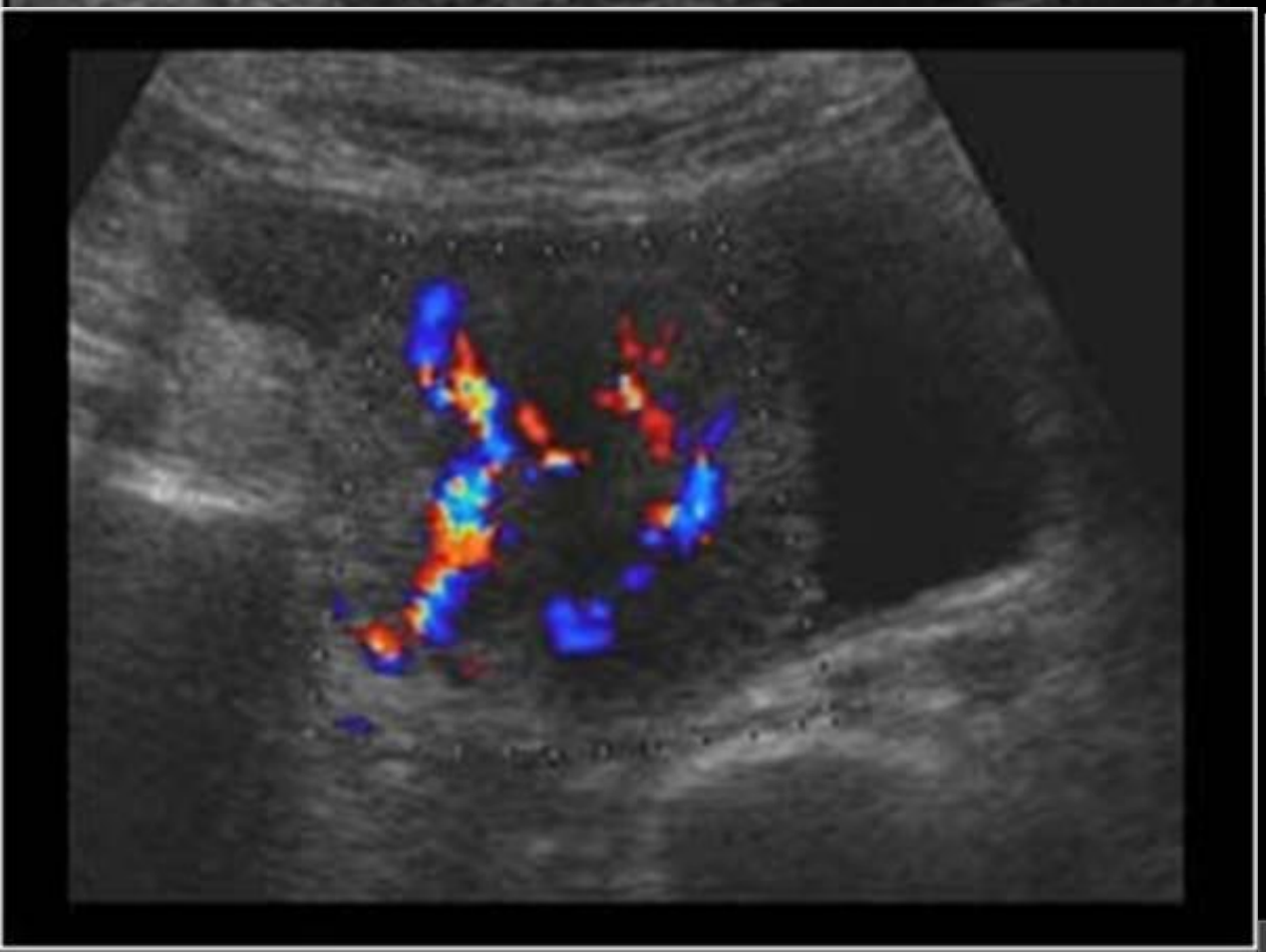


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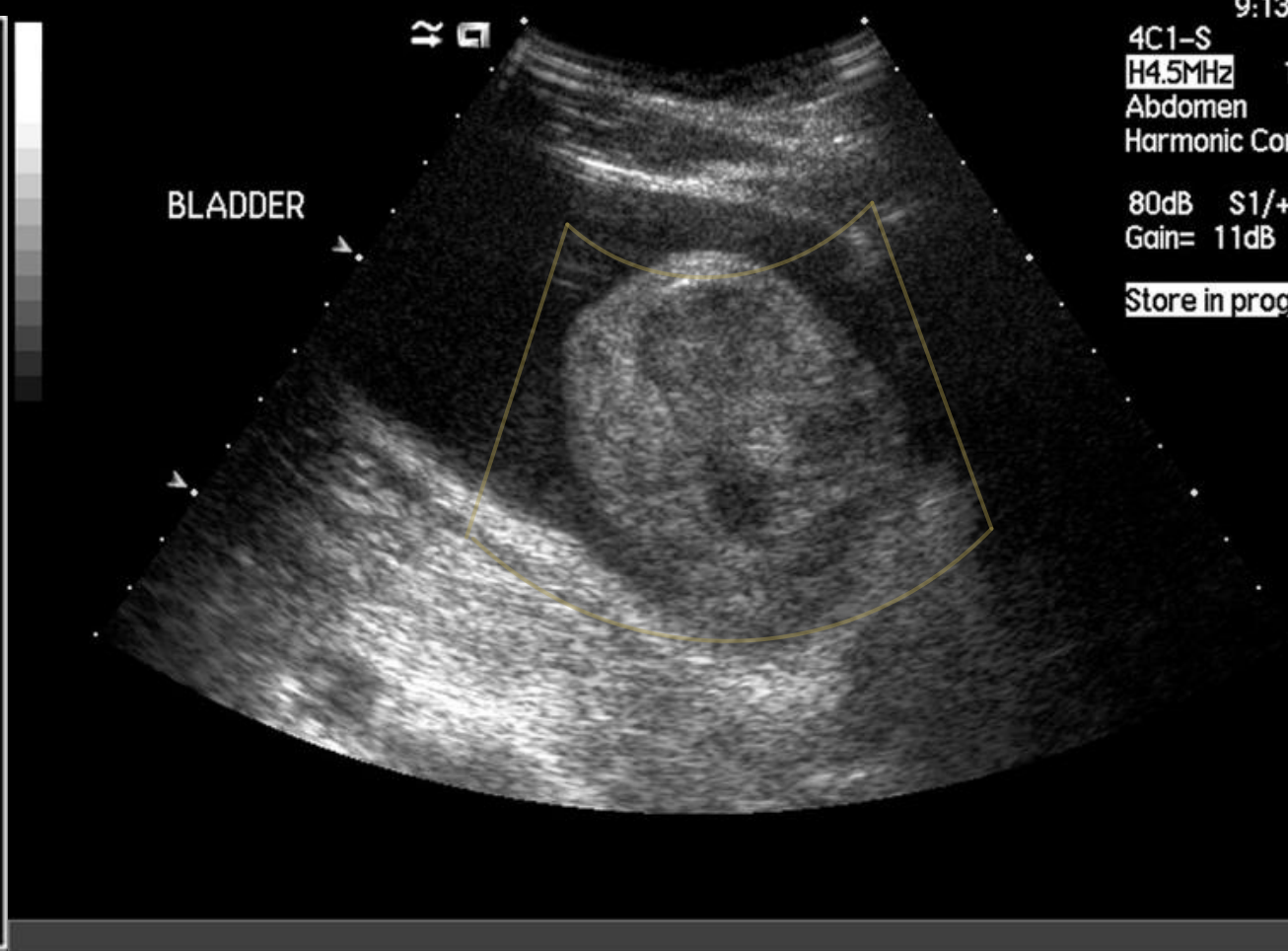
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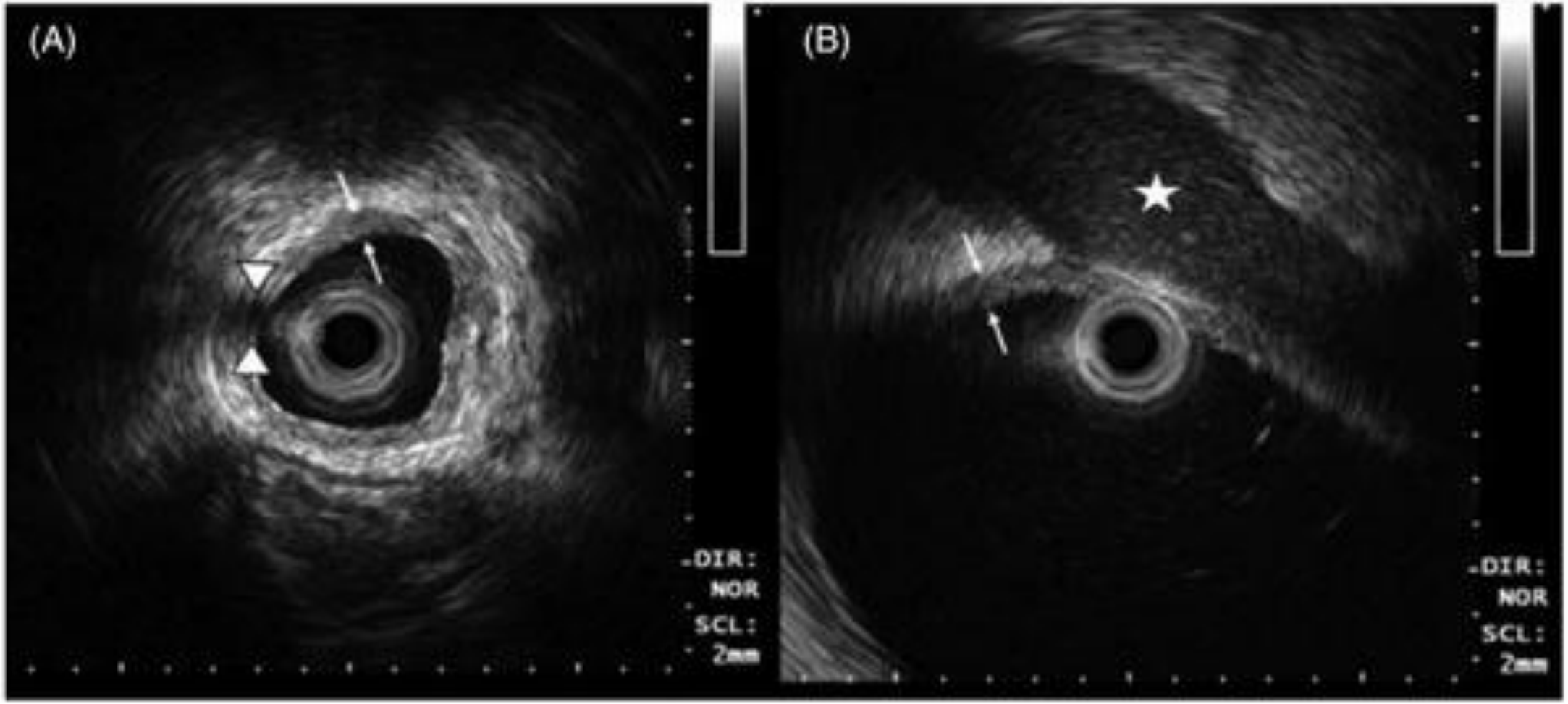
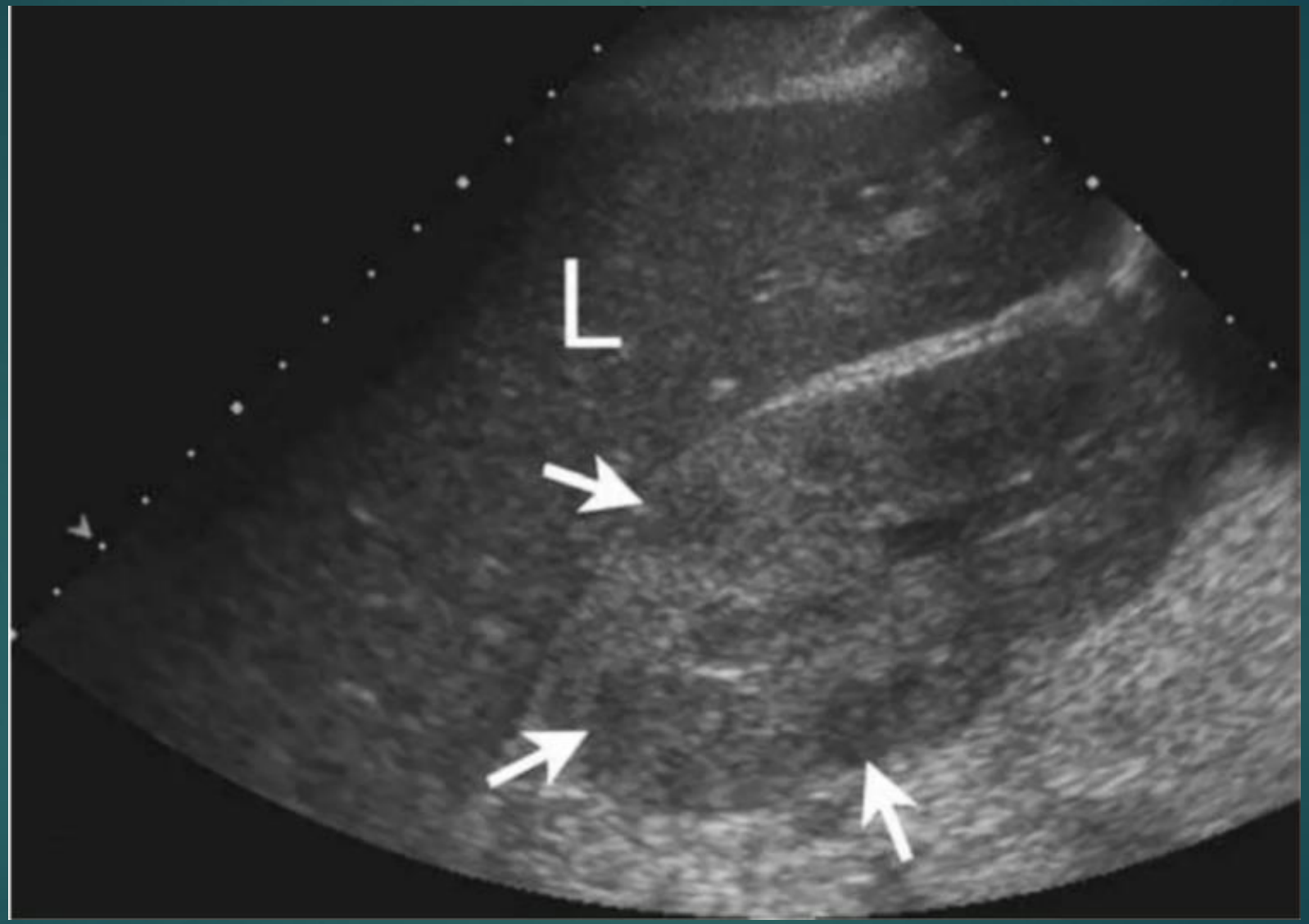


Endo-ureteric ultrasound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Renal Mets

- Lung, breast, gastrointestinal tumors and melanoma.
- Usually late in the course of a known malignancy as part of widespread disease.
- Rare as a solitary lesion and may be hard to differentiate from a renal cell carcinoma.
- Small, multifocal, bilateral
- Hypovascular

Lymphoma

- Solitary lesion (10-25%) vs Multiple lesions (50-60%) vs Diffuse infiltration
- Renal sinus involvement and perinephric space (Primary renal lymphoma).
- Hypovascular
- Direct extension from retroperitoneal adenopathy
- ?Known widespread lyphoma…… biopsy

Sheth S, Ali S, Fishman E. Imaging of renal lymphoma: patterns of disease with pathologic correlation. Radiographics. 2006 Jul-Aug;26(4):1151-68. doi: 10.1148/rg.264055125. PMID: 16844939.

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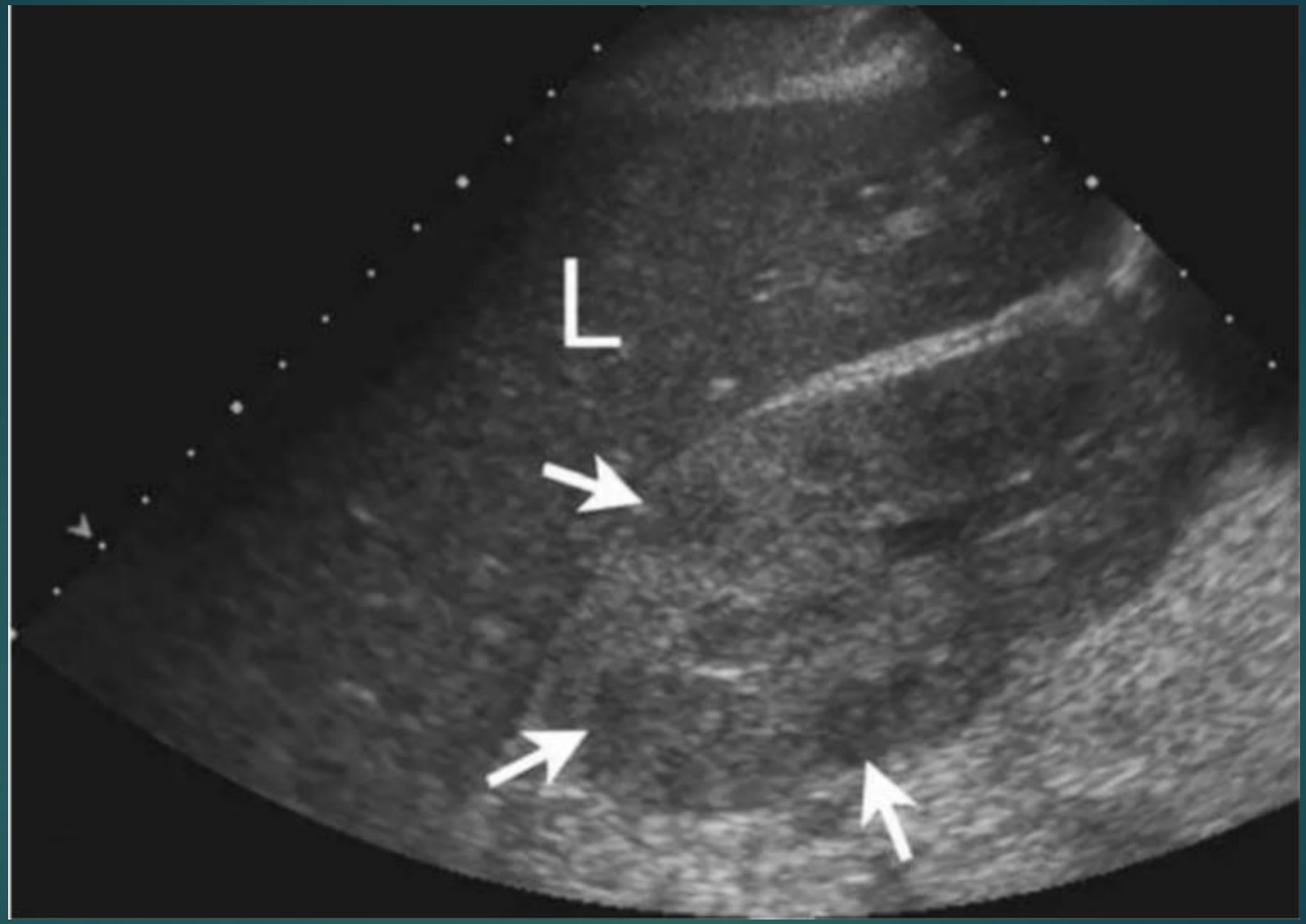

Context is key!

Take Home Points

- Maximise the use of available tools on the day – is there anything I can do here and now…?
- If in doubt – seek a radiologist in the department to review any previous cross-sectional imaging or help clinically contextualise - before patient leaves
- If still indeterminate – for cross-section

Special thanks

- Dr Chris Harvey
- Prof Adrian Lim