

RADY 401
Acute Perforated Cholecystitis

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Focused patient history and workup

53 y.o. male w/ PMHx of T2DM and HLD who presented to ED w/ 7-wk history of "sharp" RUQ pain radiating to back. Endorsed nausea/vomiting, chills.

PE - GI exam: Soft and nondistended abdomen. RUQ tenderness. +Murphy's sign w/ guarding. (Rest of exam unremarkable.)

BP	109/94
Heart Rate	115
SpO2 Pulse	
Resp	16
Temp	36.5 °C (97.7 °F)
Temp Source	Skin
SpO2	95 %

CBC	
WBC	9.1 *
RBC	4.90 *
HGB	14.7 *
HCT	44.4 *
MCV	90.6 *
MCH	30.0 *
MCHC	33.1 *
RDW	13.8 *
MPV	7.4 *
Platelet	187 *

CHEM	
Sodium	135
Potassium	3.8
Chloride	96 ▼
CO2	24.0
Bun	13
Creatinine	0.89
BUN/Creatinine Ratio	15
EGFR CKD-EPI Afric...	>90
EGFR CKD-EPI Non-A...	>90
Anion Gap	15
Glucose	194 ▲
Calcium	8.8
Magnesium	
Phosphorus	
Albumin	4.1
Total Protein	7.5
Total Bilirubin	1.0
Bilirubin, Direct	
AST	59 ▲
ALT	60
Alkaline Phosphatase	95

Differential for RUQ pain

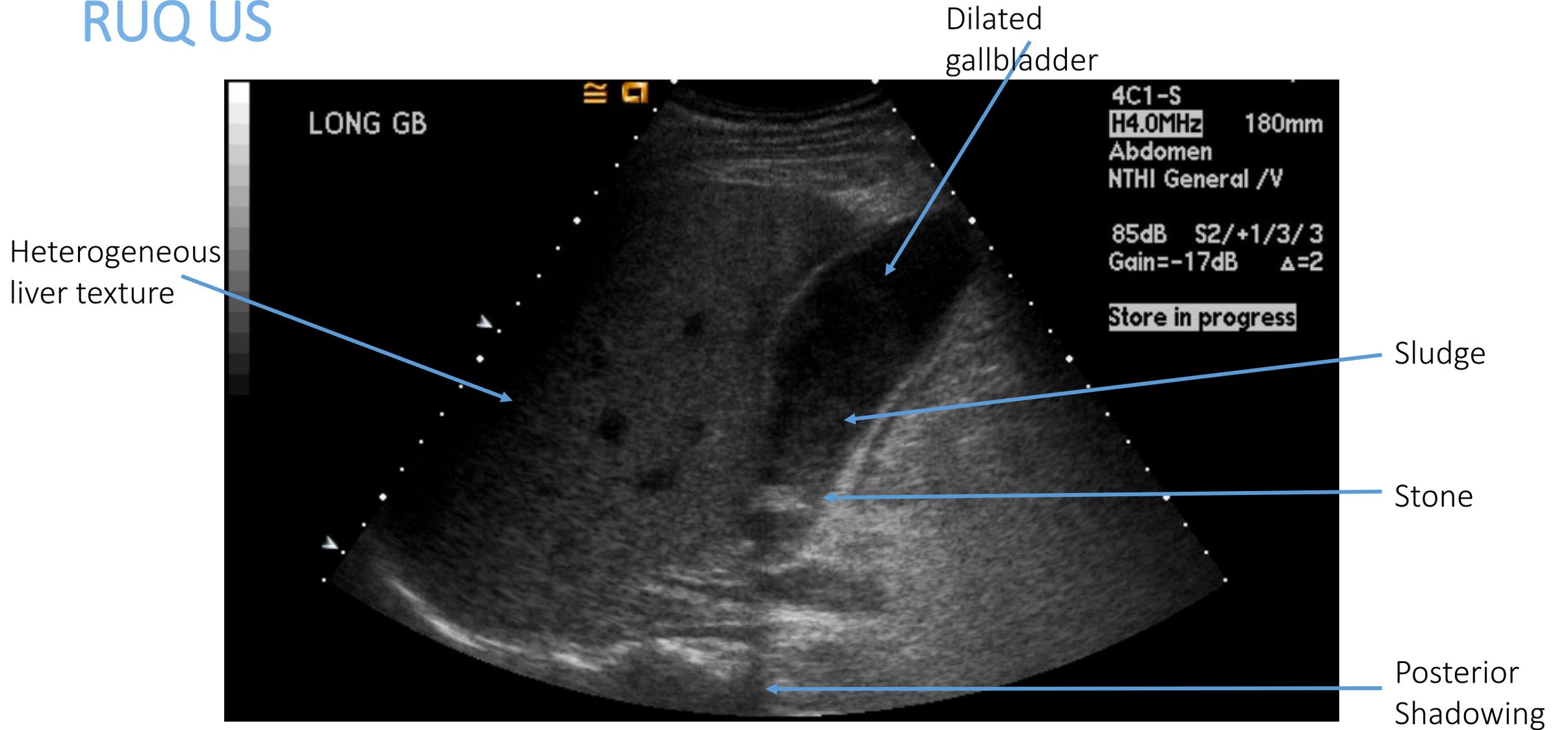
Broad, but includes:

- Cholangitis
- Cholelithiasis
- Hepatic abscess
- Pneumonia
- Nephrolithiasis
- Pyelonephritis
- Diverticulitis

List of imaging studies

- 1) US Abdomen, Right Upper Quadrant
- 2) CT Abdomen/Pelvis with IV contrast
- 3) Portable CXR

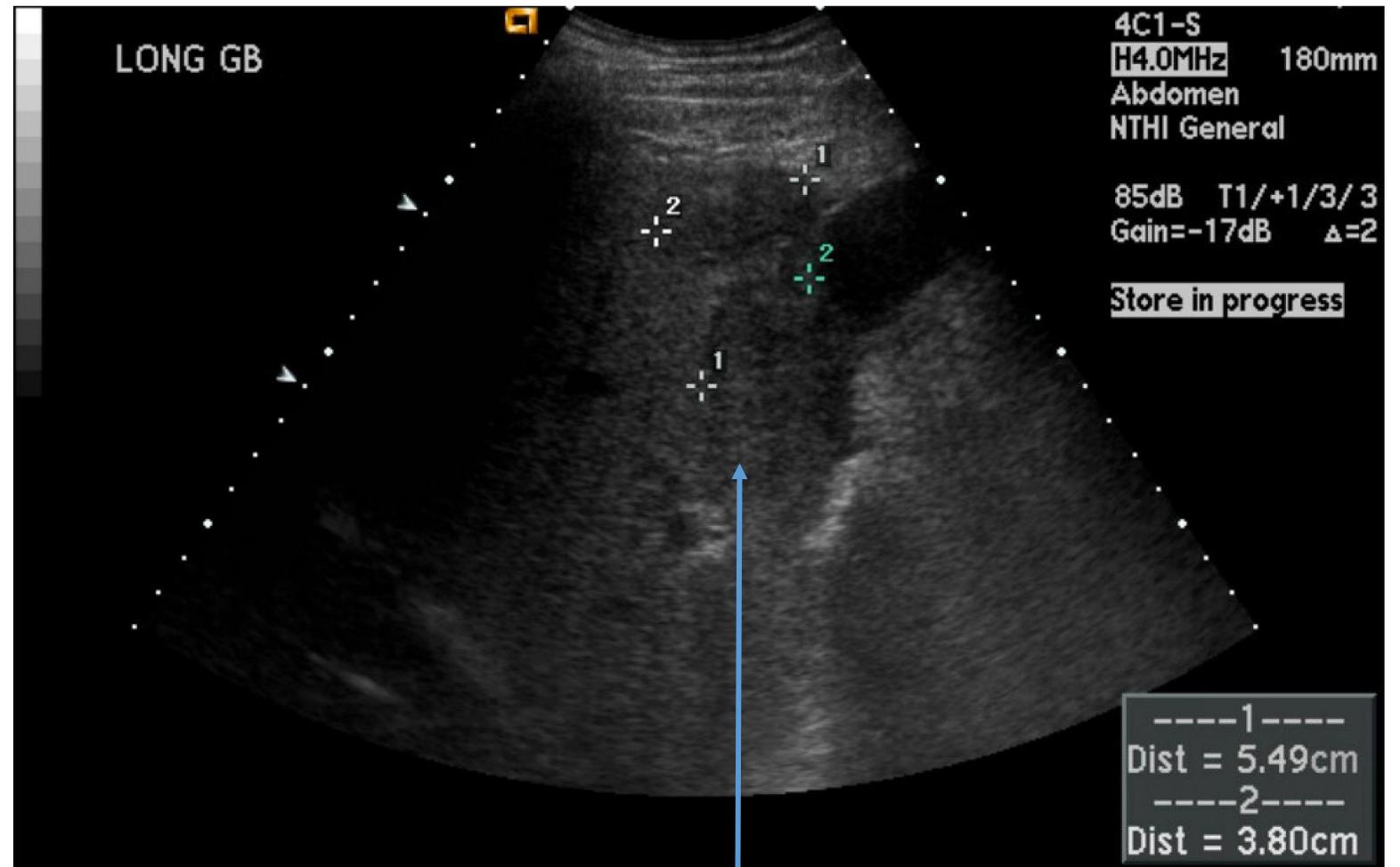
RUQ US



RUQ US

Summary of findings:

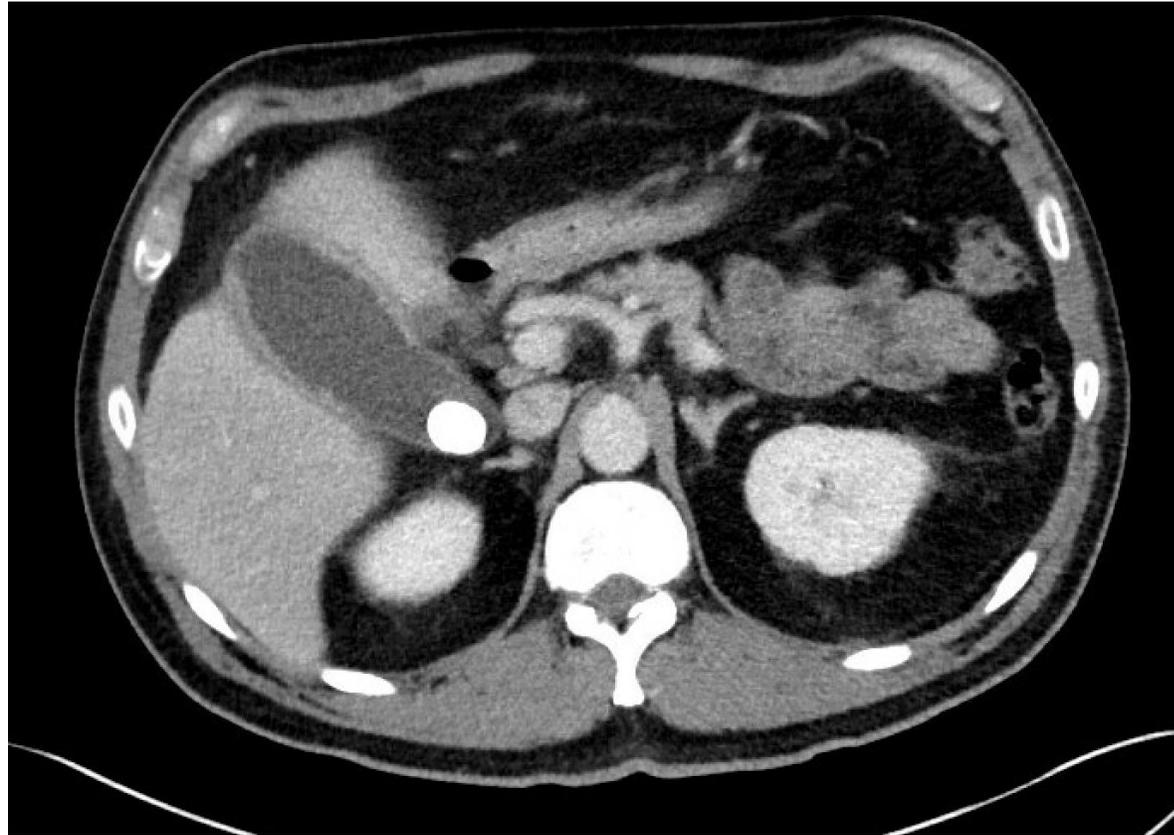
- 1) Heterogenous liver, consistent with chronic liver disease
- 2) Dilated gallbladder with sludge and stone lodged at the gallbladder neck, but no evidence of pericholecystic fluid or thickened gallbladder wall
- 3) Complex hypoechoic fluid collection adjacent to gallbladder, concerning for abscess or phlegmon



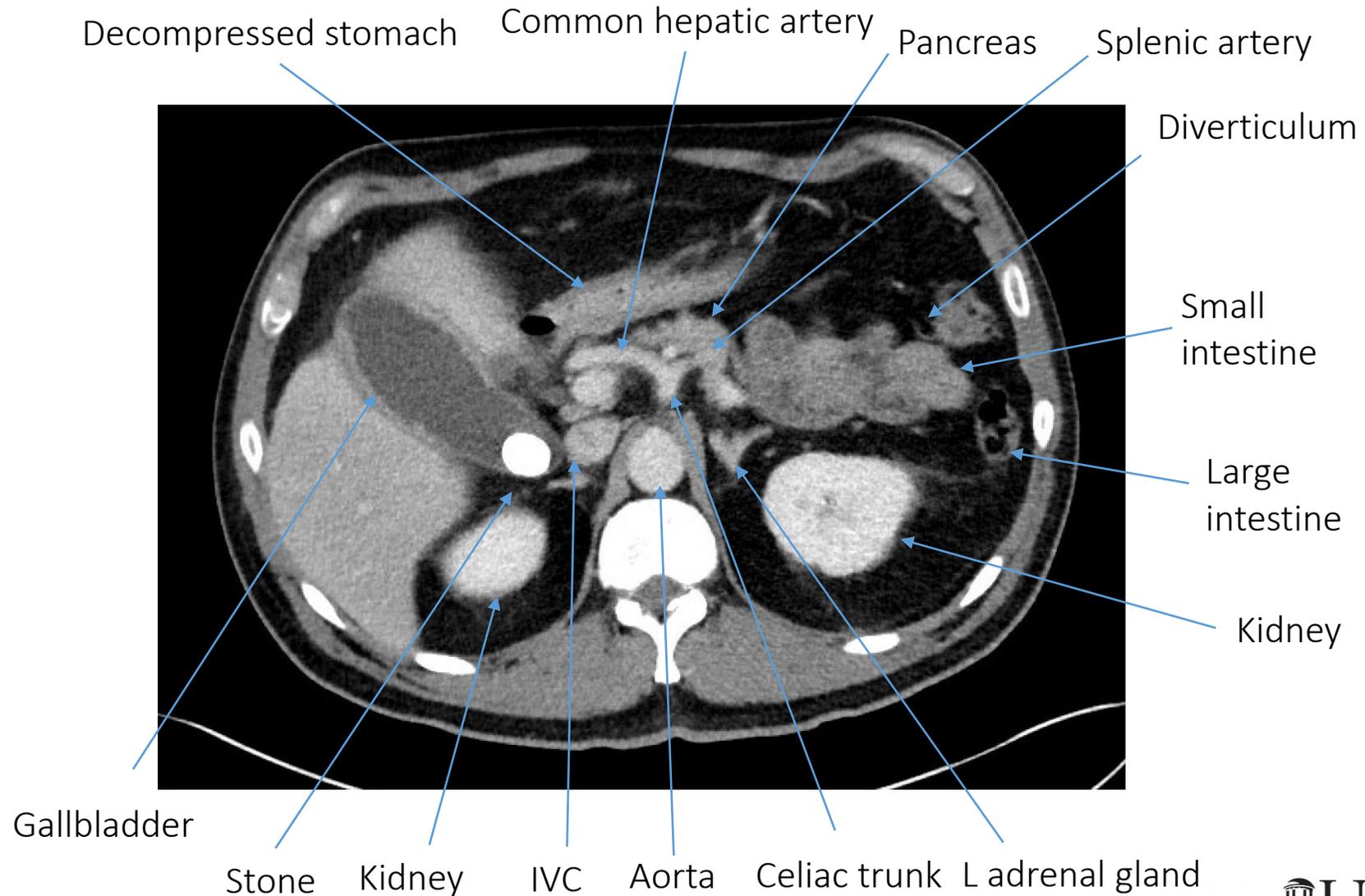
Complex hypoechoic fluid collection

CT Abd/Pel w contrast – axial view

Can you
label the
structures?



CT Abd/Pel w contrast – axial view



CT Abd/Pel w contrast – axial view

Prior 13 years earlier

- Wall is much thinner
- Gallbladder is not as distended
- 2 cm stone is non-obstructing
- No real radiographic signs of acute cholecystitis



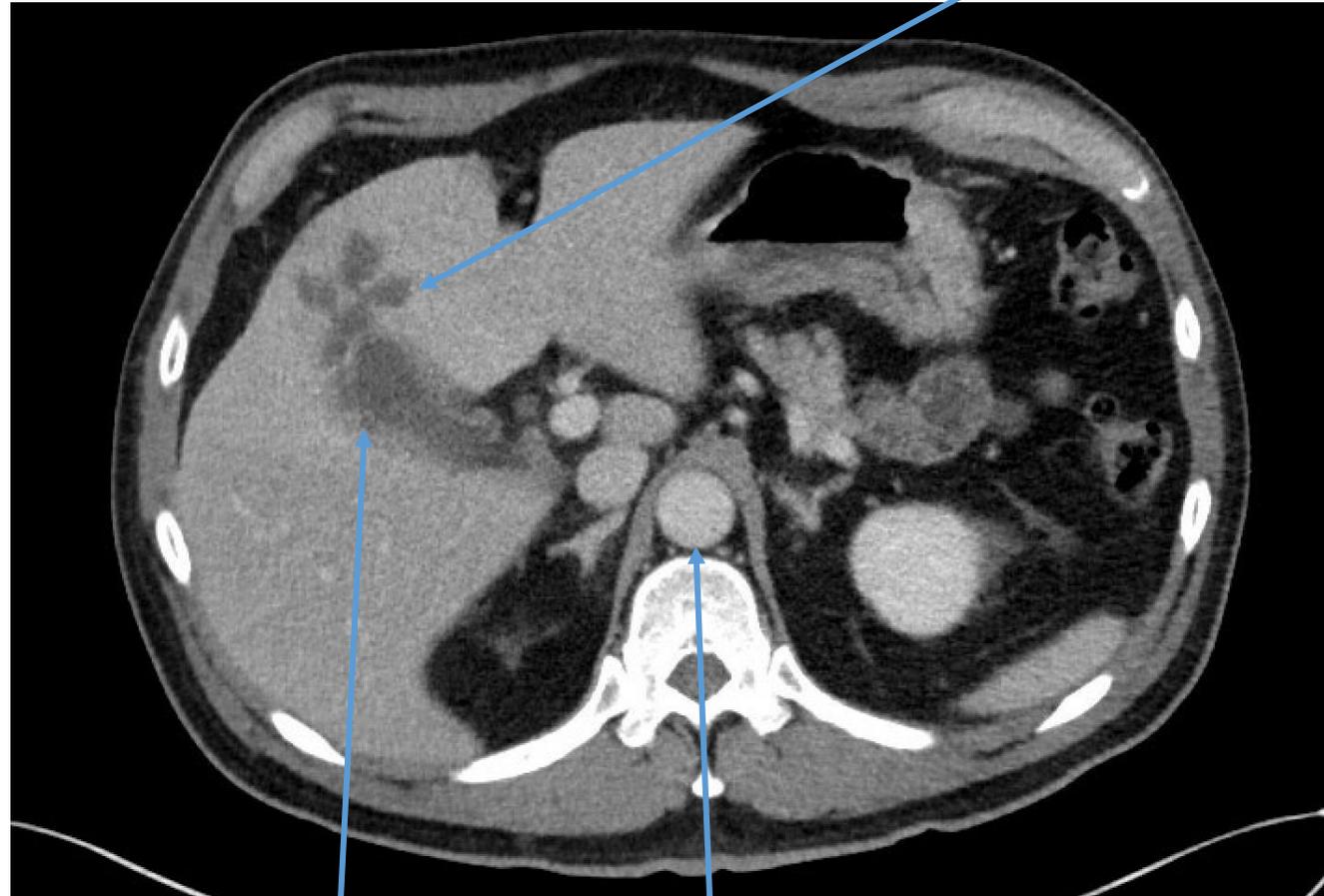
Gallbladder

Stone

CT Abd/Pel w contrast – axial view

Current CT

- 1) 2 cm stone lodged in gallbladder neck with thickening of wall
- 2) Discontinuity of superior aspect of gallbladder with 3.6 cm hypoattenuating segment in adjacent liver segment IVb, concerning for abscess



Low attenuation collection in the liver

Perforation in superior aspect of gallbladder

Aorta

Patient treatment and outcome

- Patient was started on Zosyn immediately after RUQ US findings. BCx was + for Enterobacter colacae.
- Was taken to OR for laparoscopic cholecystectomy and found to have acute perforated and gangrenous cholecystitis.
- Tolerated procedure well. Repeat BCx returned negative. Normal vital signs. Discharged on an outpatient oral antibiotic regimen.

Was the correct exam performed?

- Ultrasonography is the test of choice in the initial evaluation of RUQ pain. It may have up to 96% accuracy in the detection of stones. It is additionally useful in assessing gallbladder size, other masses, and presence or absence of pericholecystic fluid.¹
- US has a sensitivity of 88% and specificity of 80% in detecting acute cholecystitis.²
- It remains the initial study of choice even in cases of complicated cholecystitis. Some patients with this condition may have the same symptoms as those with uncomplicated cholecystitis.¹
- CT Abdomen with IV contrast is usually recommended after US as it has a negative predictive value for acute cholecystitis of ~90%.³ It also a useful exam for surgical planning, as it can allow surgeons to decide the best approach based on precise stone positioning, among other findings. The contrast can help elucidate adjacent hyperemia of the liver and wall enhancement. It is important to note, however, that sensitivity of CT for gallstones is less than US.¹

American College of Radiology's RUQ pain evaluation paradigm⁴

Variant 1: Right upper quadrant pain. Suspected biliary disease. Initial imaging.

Procedure	Appropriateness Category	Relative Radiation Level
US abdomen	Usually Appropriate	○
CT abdomen with IV contrast	May Be Appropriate	⊕⊕⊕
MRI abdomen without and with IV contrast with MRCP	May Be Appropriate	○
MRI abdomen without IV contrast with MRCP	May Be Appropriate	○
Nuclear medicine scan gallbladder	May Be Appropriate	⊕⊕
CT abdomen without IV contrast	May Be Appropriate	⊕⊕⊕
CT abdomen without and with IV contrast	Usually Not Appropriate	⊕⊕⊕⊕

Variant 2: Right upper quadrant pain. No fever or high white blood cell (WBC) count. Suspected biliary disease. Negative or equivocal ultrasound.

Procedure	Appropriateness Category	Relative Radiation Level
MRI abdomen without and with IV contrast with MRCP	Usually Appropriate	○
CT abdomen with IV contrast	Usually Appropriate	⊕⊕⊕
MRI abdomen without IV contrast with MRCP	Usually Appropriate	○
Nuclear medicine scan gallbladder	May Be Appropriate	⊕⊕
CT abdomen without IV contrast	May Be Appropriate	⊕⊕⊕
CT abdomen without and with IV contrast	Usually Not Appropriate	⊕⊕⊕⊕

Variant 3: Right upper quadrant pain. Fever, elevated WBC count. Suspected biliary disease. Negative or equivocal ultrasound.

Procedure	Appropriateness Category	Relative Radiation Level
MRI abdomen without and with IV contrast with MRCP	Usually Appropriate	○
CT abdomen with IV contrast	Usually Appropriate	⊕⊕⊕
Nuclear medicine scan gallbladder	Usually Appropriate	⊕⊕
MRI abdomen without IV contrast with MRCP	May Be Appropriate	○
CT abdomen without IV contrast	May Be Appropriate	⊕⊕⊕
CT abdomen without and with IV contrast	Usually Not Appropriate	⊕⊕⊕⊕

American College of Radiology's RUQ pain evaluation paradigm⁴

Takeaways:

- When suspecting biliary disease as the cause for RUQ pain, US is the preferred initial imaging modality
- If US is equivocal AND patient has no fever or elevated WBC count, CT with contrast and MRI with or without contrast is usually recommended
- If US is equivocal AND patient has fever OR elevated WBC count, a nuclear medicine scan of the gallbladder may additionally be considered

Classic findings of (Perforated) Acute Cholecystitis⁵

Radiographic features of acute cholecystitis⁶:

On **ultrasound**:

- - Echogenic gallstones with posterior shadowing
- - >3 mm thickening of gallbladder walls
- - Distension of gallbladder >40 mm
- - Pericholecystic and perihepatic fluid collections

On **CT**:

- - Pericholecystic fat stranding
- - Hyperattenuation of gallbladder parenchyma
- - Can show gas in bile duct ("Emphysematous cholecystitis")
- - Several other findings

Radiation and cost considerations of US and CT

US:

- Approximate cost in Chapel Hill, NC⁷: \$233
- Radiation dose: none

CT:

- Approximate cost in Chapel Hill, NC⁷: \$1515
- Radiation dose: 7.7 mSv⁸

Quiz Yourself

- 1) Which of the following imaging modalities has a greater sensitivity for detecting gallstones: CT or US?
- 2) Why might a CXR be considered in the context of a patient presenting with RUQ pain?
- 3) On ultrasound, approximately what thickness of the gallbladder wall is consistent with cholecystitis?
- 4) What are some features of acute cholecystitis detectable on CT?

Quiz Yourself

- 1) Which of the following imaging modalities has a greater sensitivity for detecting gallstones: CT or **US**?
- 2) Why might a CXR be considered in the context of a patient presenting with RUQ pain? **pneumonia may cause RUQ pain**
- 3) On ultrasound, approximately what thickness of the gallbladder wall is consistent with cholecystitis? **3 mm**
- 4) What are some features of acute cholecystitis detectable on CT?
Pericholecystic fat stranding, edema, hyperattenuation of gallbladder parenchyma, adjacent hyperemia of liver, gas in bile duct wall

UNC Top Three

- 1) Ultrasound is the preferred imaging modality in the initial assessment of right upper quadrant pain, even when suspecting complicated cholecystitis.
- 2) Radiographic findings consistent with acute cholecystitis include dilation of gallbladder, pericholecystic fluid, thickening of gallbladder wall, and adjacent fat stranding.
- 3) A CT scan with contrast is more useful in preoperative planning and can assist with assessing unique features of complicated cholecystitis, including perforation and adjacent abscess formation.

References

- 1) Bennett GL. Evaluating Patients with Right Upper Quadrant Pain. *Radiol Clin North Am* 2015;53:1093-130
- 2) Shea JA, Berlin JA, Escarce JJ, et al. Revised estimates of diagnostic test sensitivity and specificity in suspected biliary tract disease. *Arch Intern Med* 1994;154:2573-81.
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- 4) American College of Radiology. ACR Appropriateness Criteria®: Jaundice. Available at: <https://acsearch.acr.org/docs/69497/Narrative/>. Accessed November 30, 2018.
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- 7) Healthcare Bluebook, 2022. (Accessed on March 17, 2022.)
- 8) Milano MT, Mahesh M, Mettler FA, Elee J, Vetter RJ. Patient Radiation Exposure: Imaging During Radiation Oncology Procedures: Executive Summary of NCRP Report No. 184. *J Am Coll Radiol*. 2020 Sep;17(9):1176-1182. doi: 10.1016/j.jacr.2020.02.002. Epub 2020 Feb 24. PMID: 32105647.