

Acute Abdominal Pain and
Introduction to Imaging

UNC Radiology Residency Educational Scholarship

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SCHOOL OF MEDICINE
Radiology

Learning objectives

By the end of this activity, participants will be able to:

1. Describe the differential diagnoses for abdominal pain.
2. Understand the various imaging modalities.
3. Describe a suggested approach to reviewing abdominal radiographs.
4. Understand the imaging basics of appendicitis, diverticulitis, cholecystitis, renal stone disease, small bowel obstruction.

Outline

1. Background
2. Modalities
3. Cases !
4. Wrap up/Questions

Background

Acute abdominal pain: 5% of ER visits

- 10% of these patients have serious/life-threatening condition

H&P: first and most important step

Labs and imaging are supplementary

Common Causes Abd Pain

- Appendicitis
- Diverticulitis
- Cholecystitis
- Bowel obstruction
- Renal stones
- Perforation
- Intussusception
- Ischemia
- AAA rupture

This is not an all-inclusive list, but a very good start on the diseases we see in radiology!

Modalities: Radiography





- Acute abdominal series (AAS) - 3 views
 - AP supine abdomen
 - AP upright abdomen
 - PA upright chest
- Common indications:
 - Bowel perforation/free air
 - Obstruction
- Effective radiation dose: 0.1-1 mSv

Radiation Dose

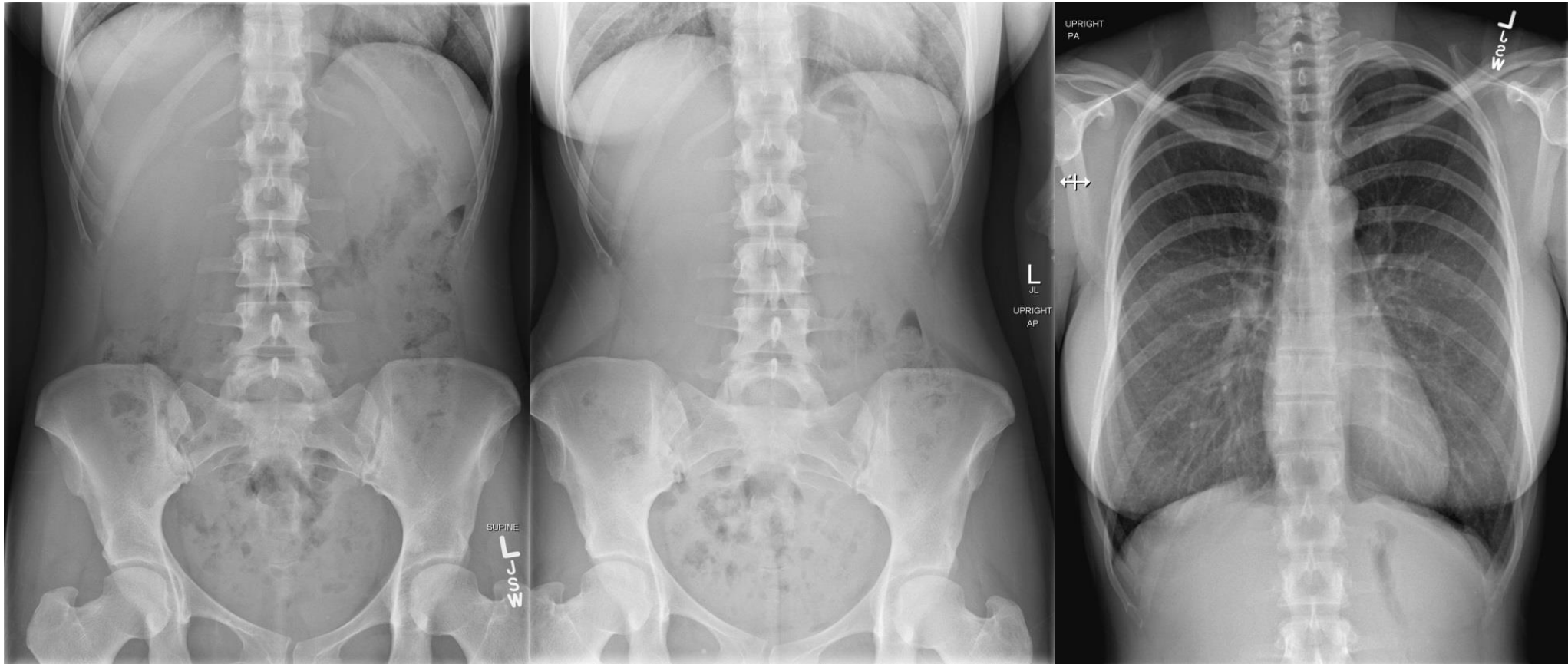
Two types of effects:

1. Deterministic: at a certain dose burns, hair loss, skin necrosis WILL occur
2. Stochastic: increased risk with increased dose
very rough estimate: 10mSv in an adult
~1/1000 risk of cancer

Radiation Dose to Adults From Common Imaging Examinations

Procedure		Approximate effective radiation dose	Comparable to natural background radiation for
 ABDOMINAL REGION	Computed Tomography (CT) — Abdomen and Pelvis	10 mSv	3 years
	Computed Tomography (CT) — Abdomen and Pelvis, repeated with and without contrast material	20 mSv	7 years
	Computed Tomography (CT) — Colonography	6 mSv	2 years
	Intravenous Pyelogram (IVP)	3 mSv	1 year
	Barium Enema (Lower GI X-ray)	8 mSv	3 years
	Upper GI Study With Barium	6 mSv	2 years
 BONE	Spine X-ray	1.5 mSv	6 months
	Extremity (hand, foot, etc.) X-ray	0.001 mSv	3 hours
 CENTRAL NERVOUS SYSTEM	Computed Tomography (CT) — Head	2 mSv	8 months
	Computed Tomography (CT) — Head, repeated with and without contrast material	4 mSv	16 months
	Computed Tomography (CT) — Spine	6 mSv	2 years
 CHEST	Computed Tomography (CT) — Chest	7 mSv	2 years
	Computed Tomography (CT) — Lung Cancer Screening	1.5 mSv	6 months
	Chest X-ray	0.1 mSv	10 days

Modalities: AAS



AP supine abdomen

AP upright abdomen

PA chest

Contrast

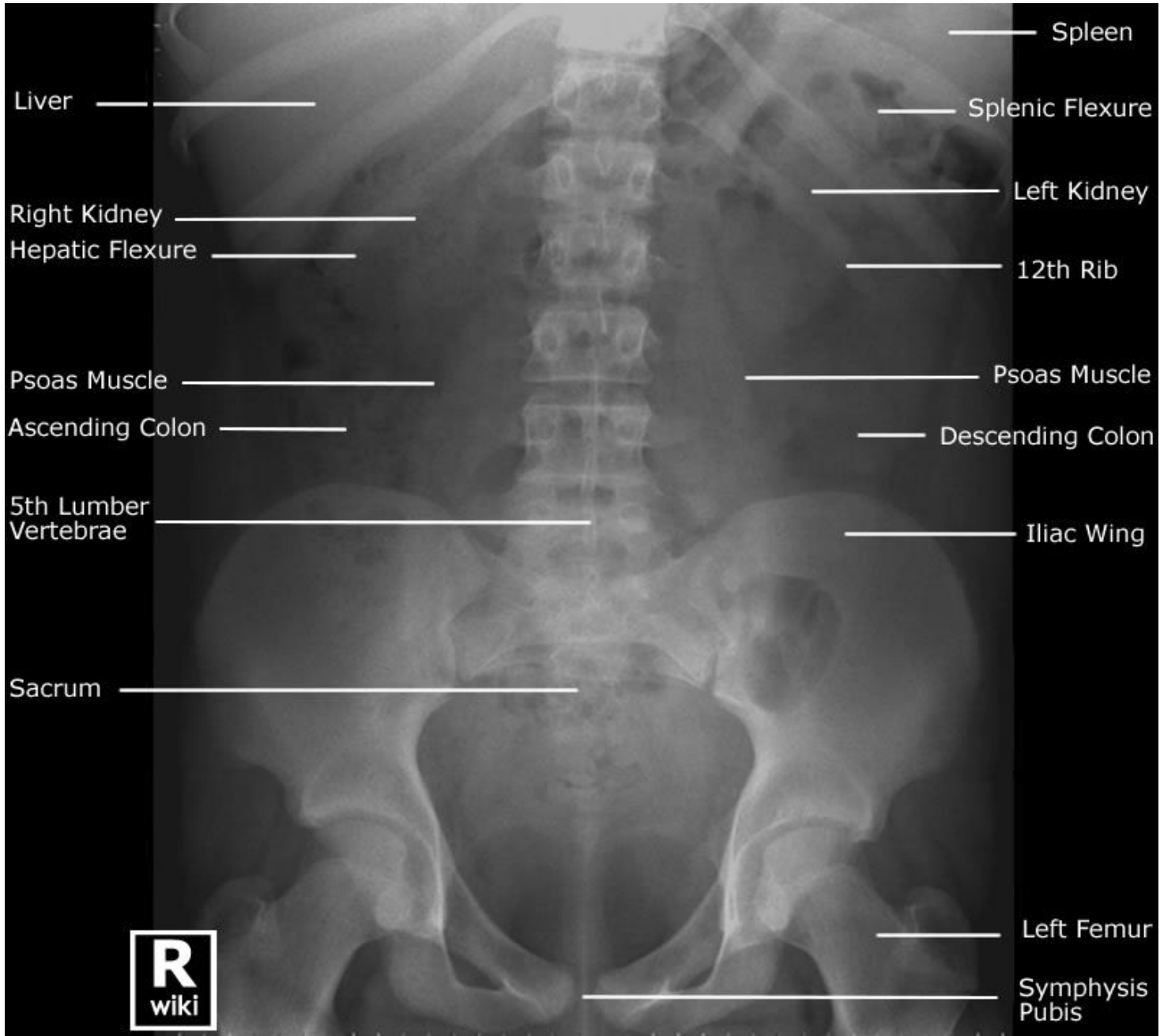
Various tissues attenuate the x-ray beam differently.

Hypodense or hypoattenuating

- Air
- Fat
- Soft tissue
- Bone
- Metal



Hyperdense or hyperattenuating



Liver

Right Kidney

Hepatic Flexure

Psoas Muscle

Ascending Colon

5th Lumbar Vertebrae

Sacrum



Spleen

Splenic Flexure

Left Kidney

12th Rib

Psoas Muscle

Descending Colon

Iliac Wing

Left Femur

Symphysis Pubis

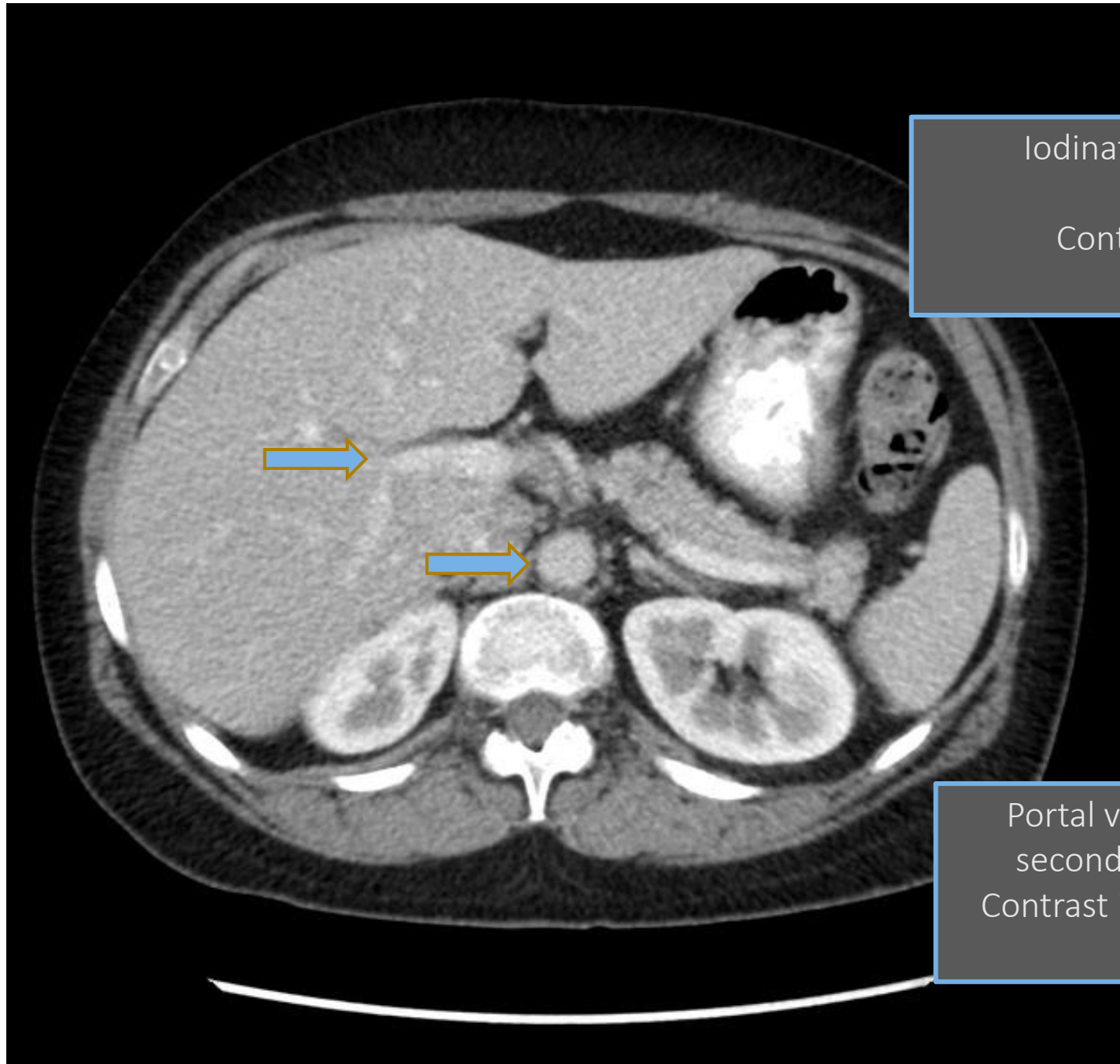
Modalities: CT

CT sensitivity and specificity is best if intravenous contrast is given.
Exceptions: renal stone disease, renal failure patients

Rotating X-ray tube around patient
Allows for 2D images
(more on this in future lectures)

Higher radiation than AAS: 5-10 mSv

CT Abdomen and pelvis at UNC: recons in axial, coronal, and sagittal planes with soft tissue algorithm. Standard 5 mm axial slices



Iodinated contrast given IV
Contrast also given PO

Portal venous phase timed at 70 seconds post contrast injection
Contrast in the portal veins, hepatic veins, and IVC

Modalities: Ultrasound

Uses sound waves (rather than ionizing radiation)

Indications:

RUQ pain: gallstones/cholecystitis/bile duct stones

appendicitis in kids/pregnancy

Kidney stones

Pelvis US for torsion/adnexal pain

Modalities: Ultrasound



Modalities: MR

Less frequently used modality in acute setting

Scan time >>> CT or US

Pros: Better soft tissue resolution

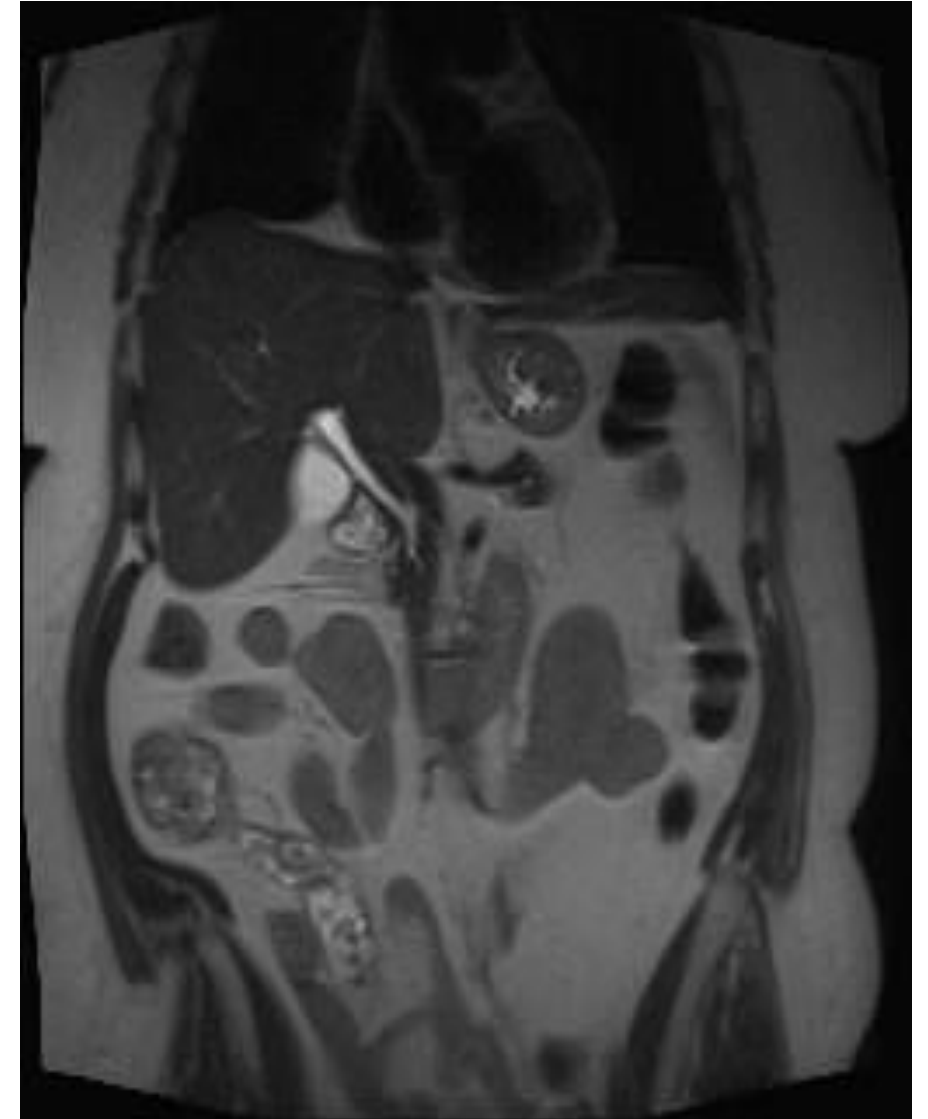
Cons: magnet safety, long scan time, \$\$\$

Indications:

Pregnant appy

Suspect CBD obstruction after US = MRCP

Problem solving



Outline

1. Background

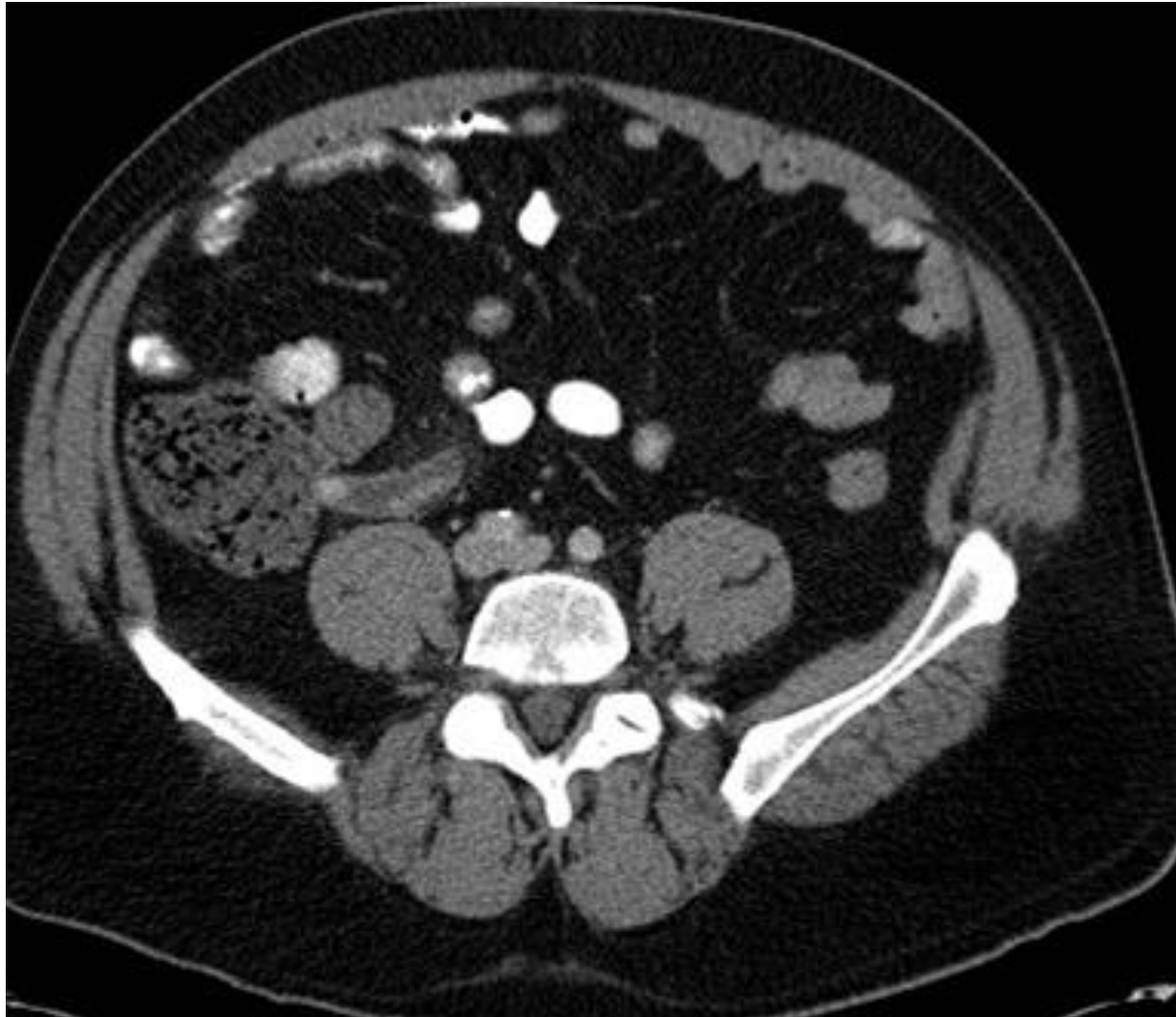
2. Modalities

3. Cases !

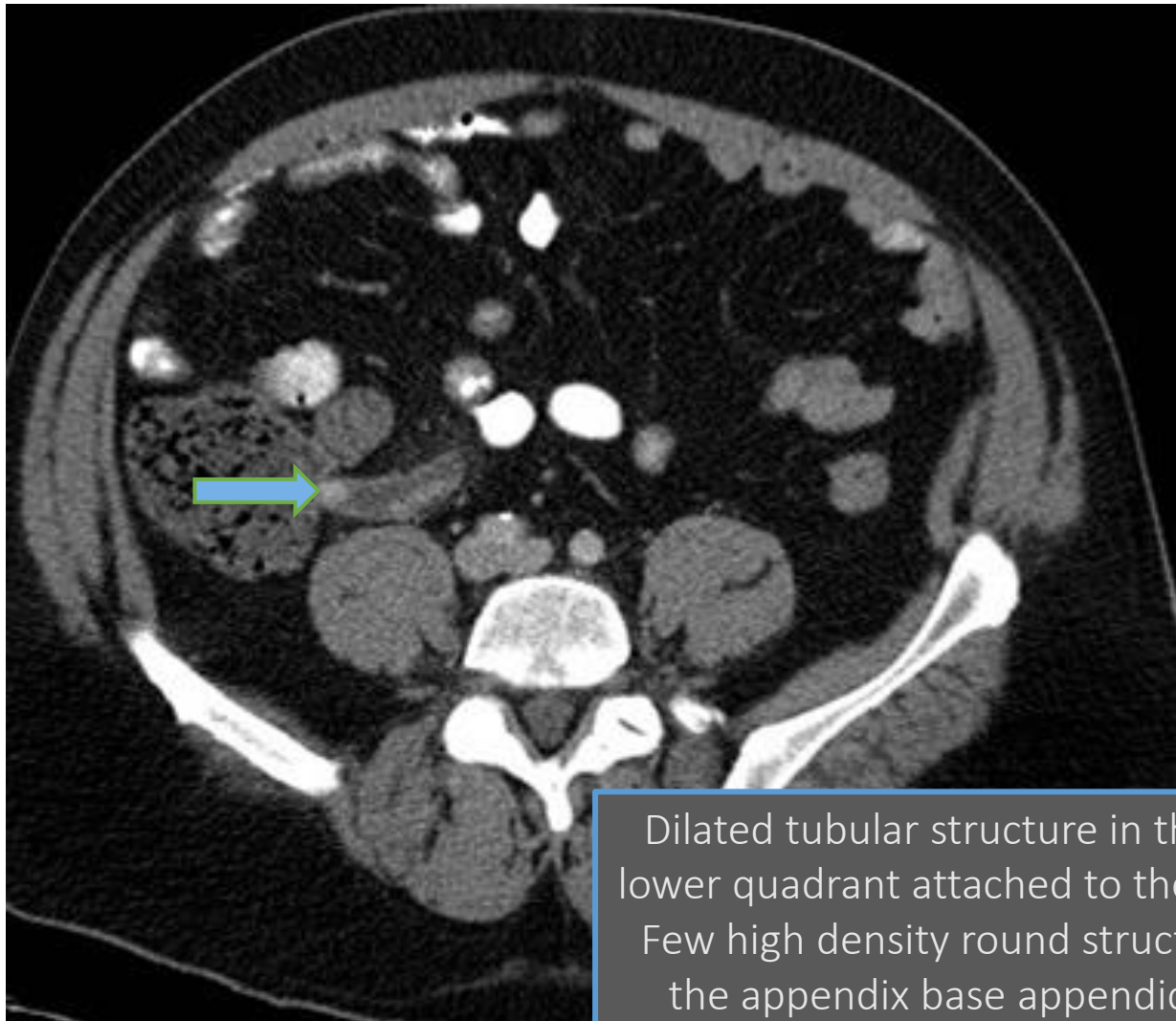


4. Wrap up/Questions

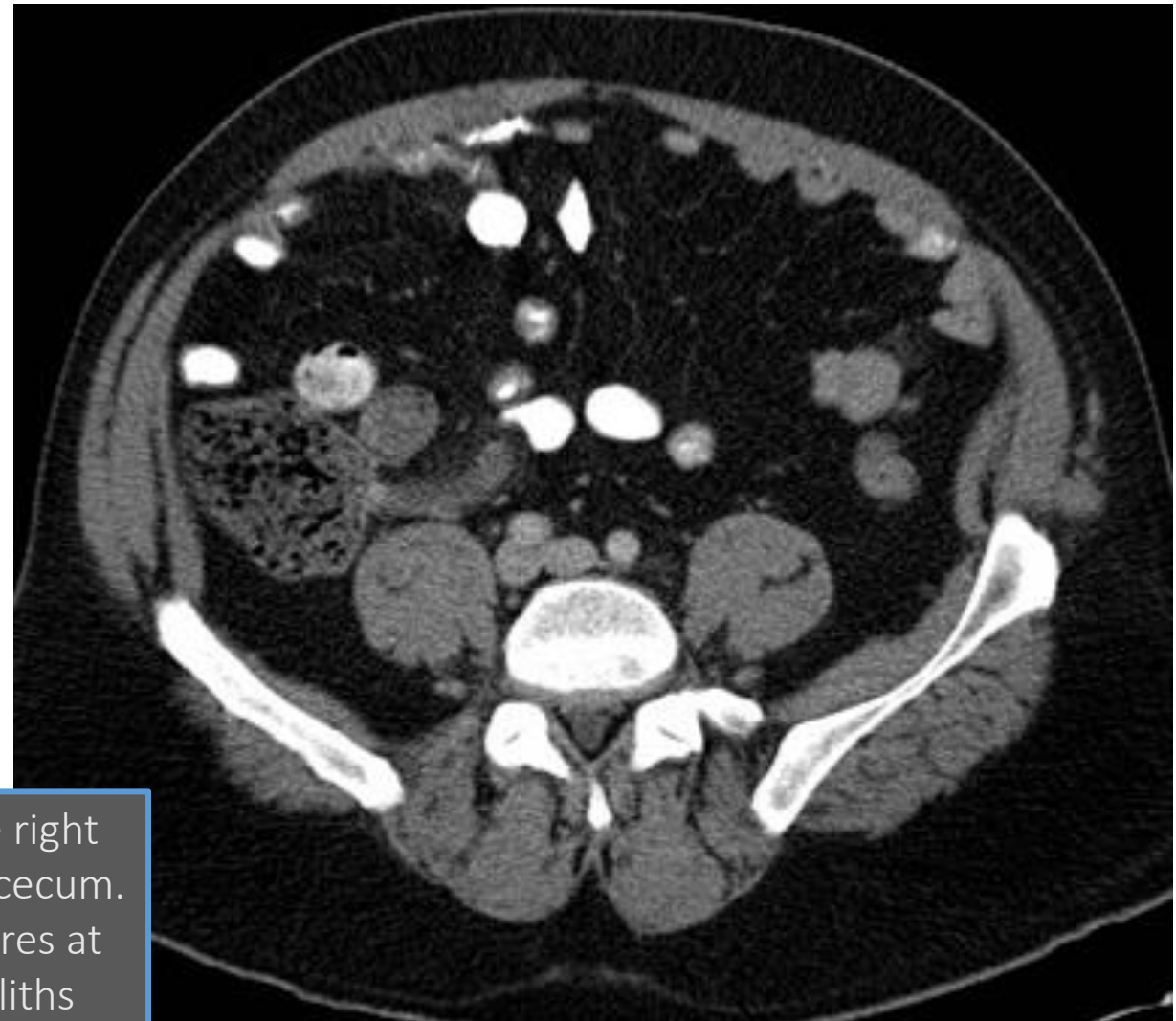
Case 1: RLQ Pain



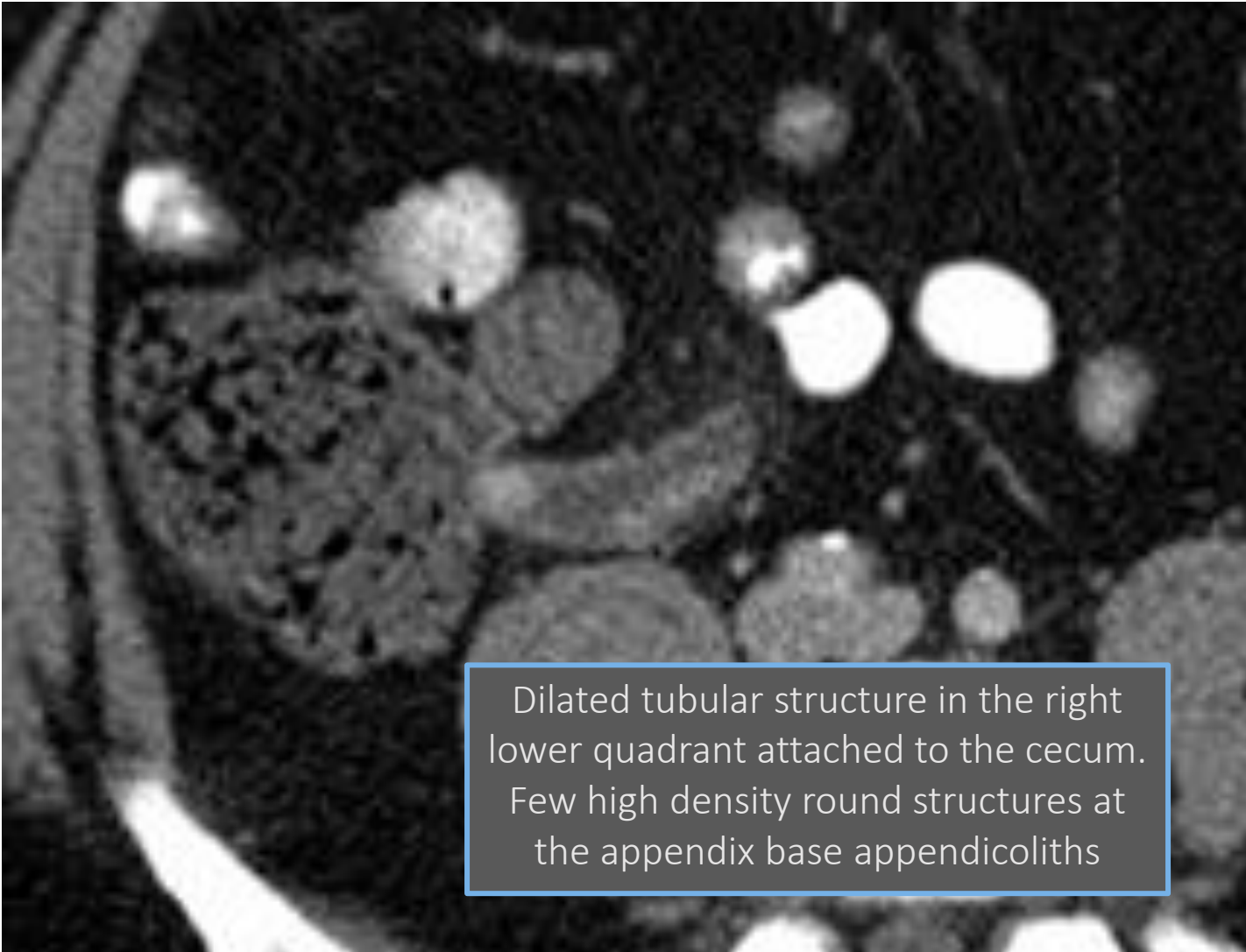
Case 1: RLQ Pain



Dilated tubular structure in the right lower quadrant attached to the cecum. Few high density round structures at the appendix base appendicoliths



Case 1: RLQ Pain



Appendicitis

CT in adults, US in kids

Imaging findings:

- dilated appendix

- >6mm

- Fat stranding

- Fluid

- Appendicolith

- +/- abscess

Case 2: Crampy LLQ Pain



Case 2: Crampy LLQ Pain



Diverticulitis

CT test of choice

90% sigmoid

Imaging findings:

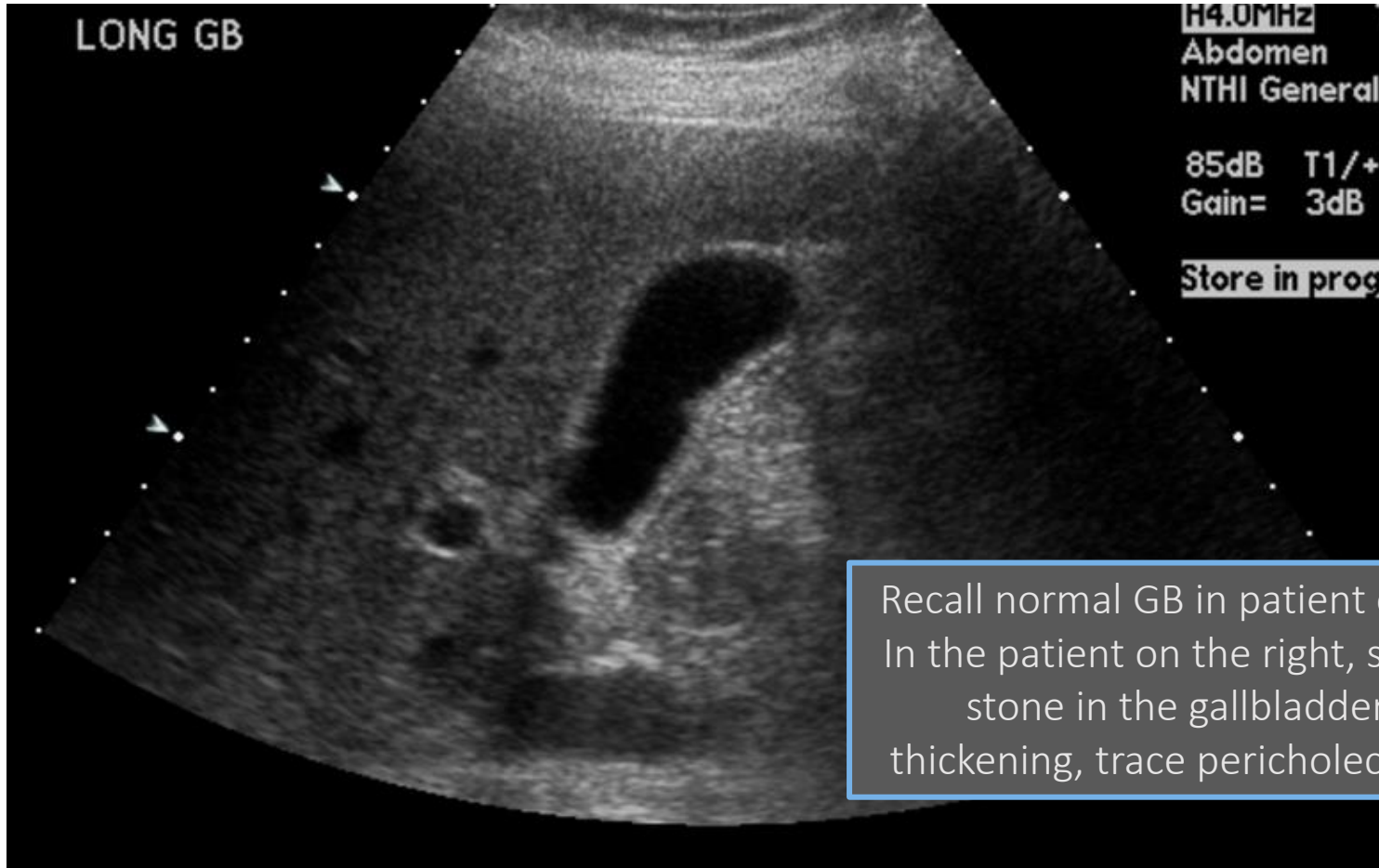
- Diverticulosis

- Fat stranding

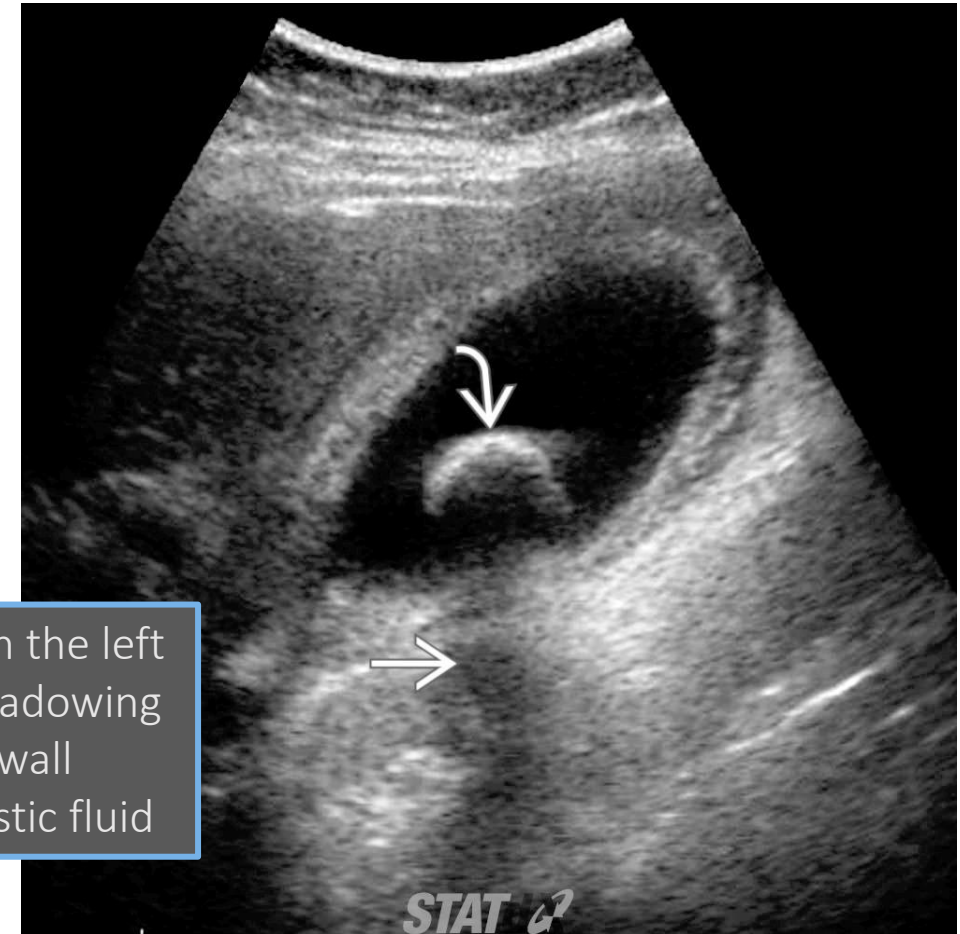
- Bowel wall thickening

- +/- free air, abscess

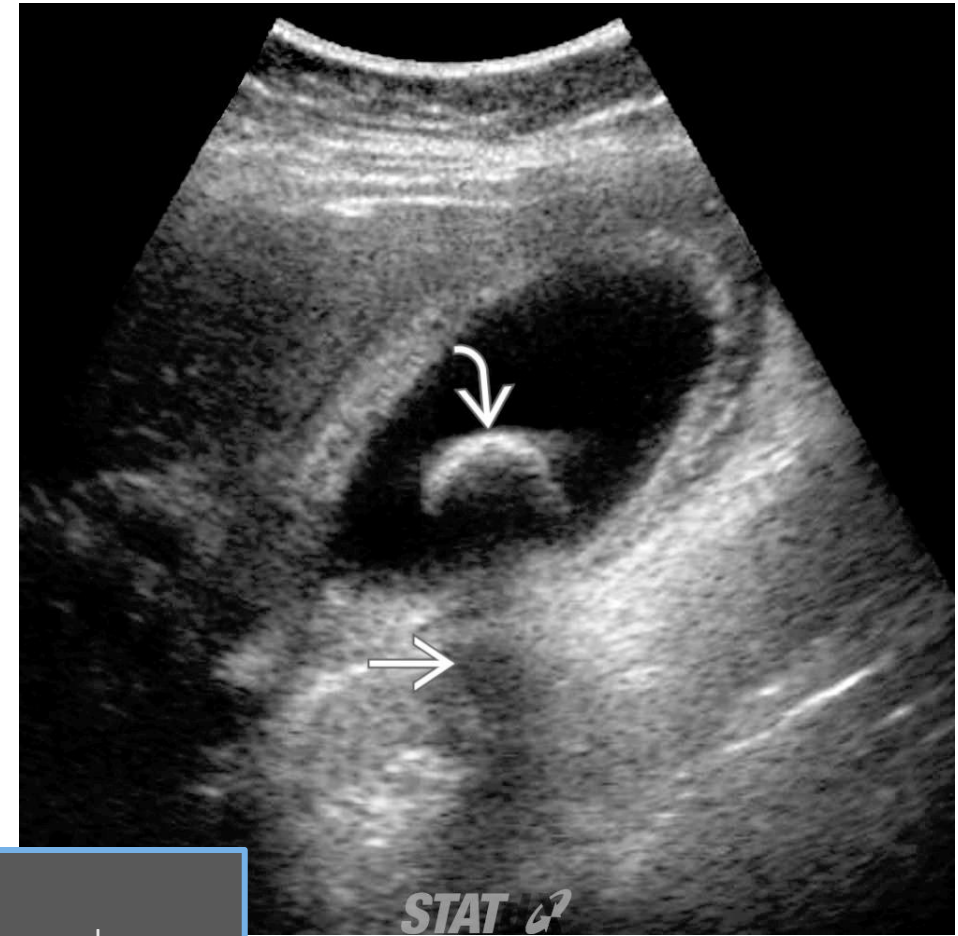
Case 3: RUQ Pain



Recall normal GB in patient on the left
In the patient on the right, shadowing
stone in the gallbladder, wall
thickening, trace pericholecystic fluid



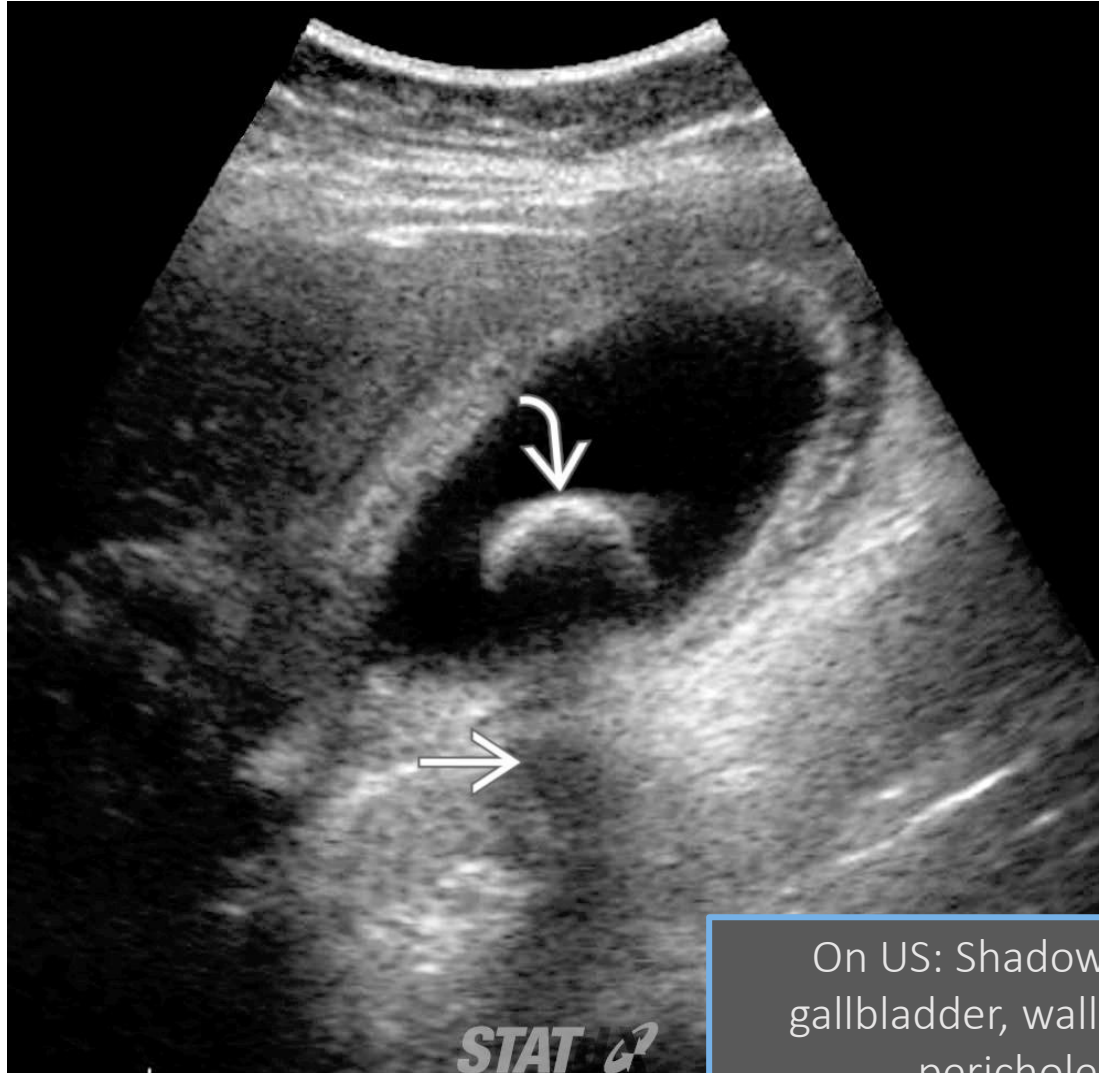
Case 3: RUQ Pain



Two important artifacts on ultrasound:

- Left: Posterior enhancement (enhanced through transmission)
- Right: Shadowing

Case 3: RUQ Pain



Cholecystitis

US initial modality; MRI or CT also used

Imaging findings:

Wall thickening

Gallstones

Pericholecystic fluid

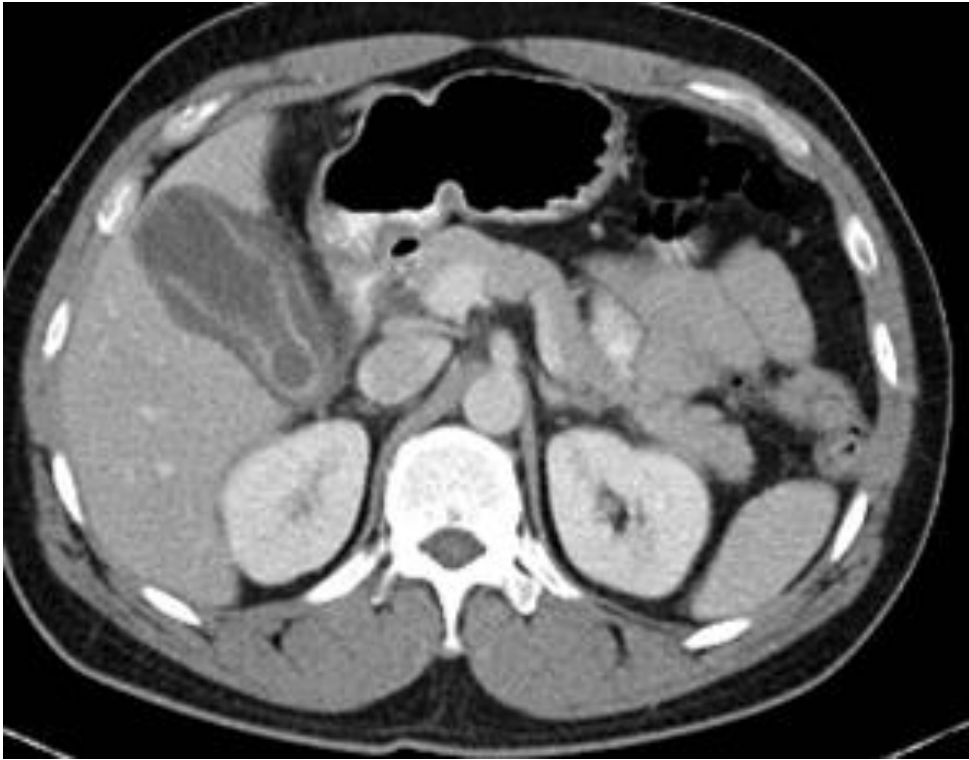
Murphy's sign on US

+/- perforation

abscess

On US: Shadowing stone in the gallbladder, wall thickening, trace pericholecystic fluid

Case 3: RUQ Pain



On CT: Wall thickening, gallbladder mucosal enhancement, and pericholecystic fat stranding



Cholecystitis

US initial modality; MRI or CT also used

Imaging findings:

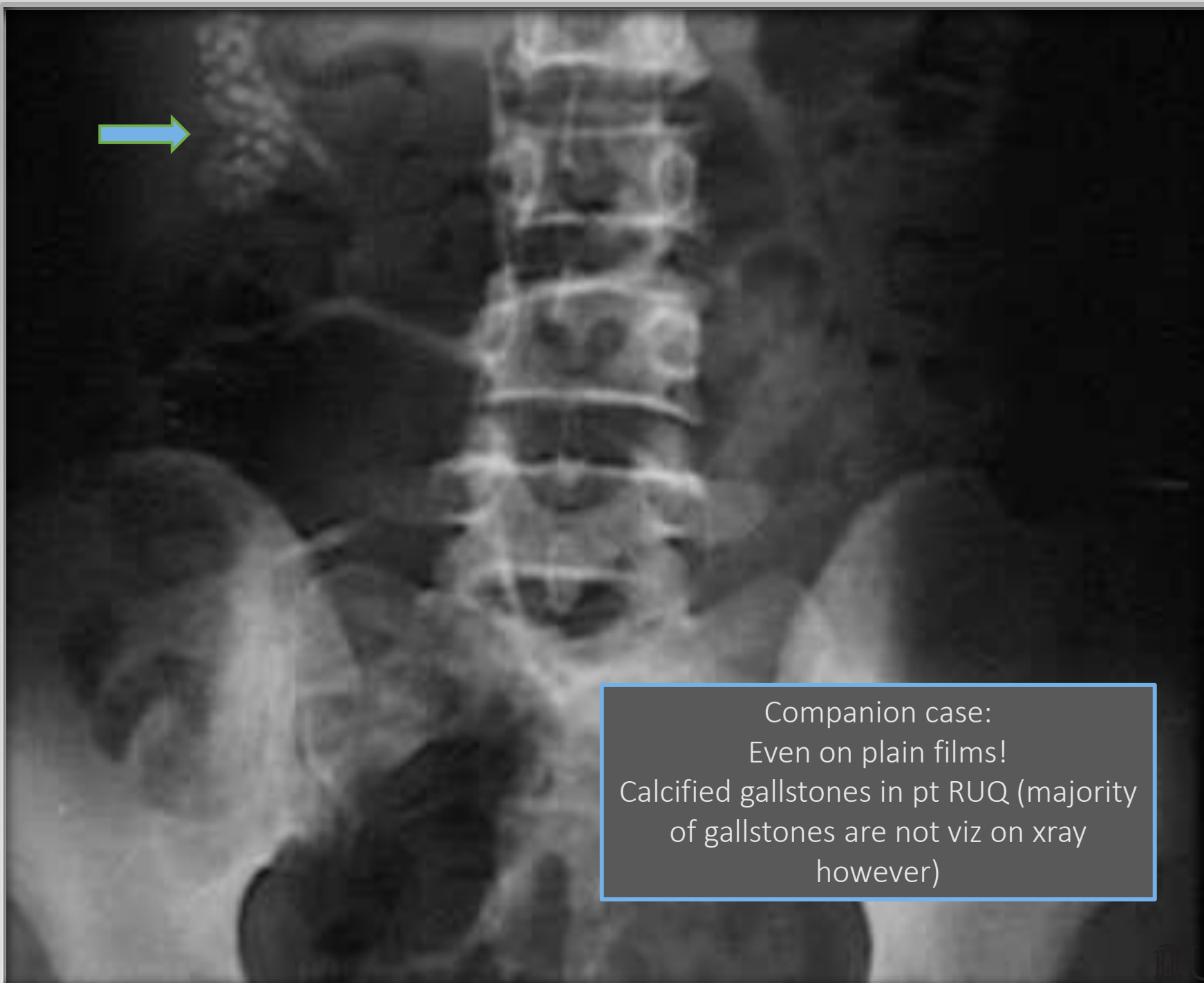
Wall thickening

Gallstones

Pericholecystic fluid

Murphy's sign on US

+/- perforation
abscess

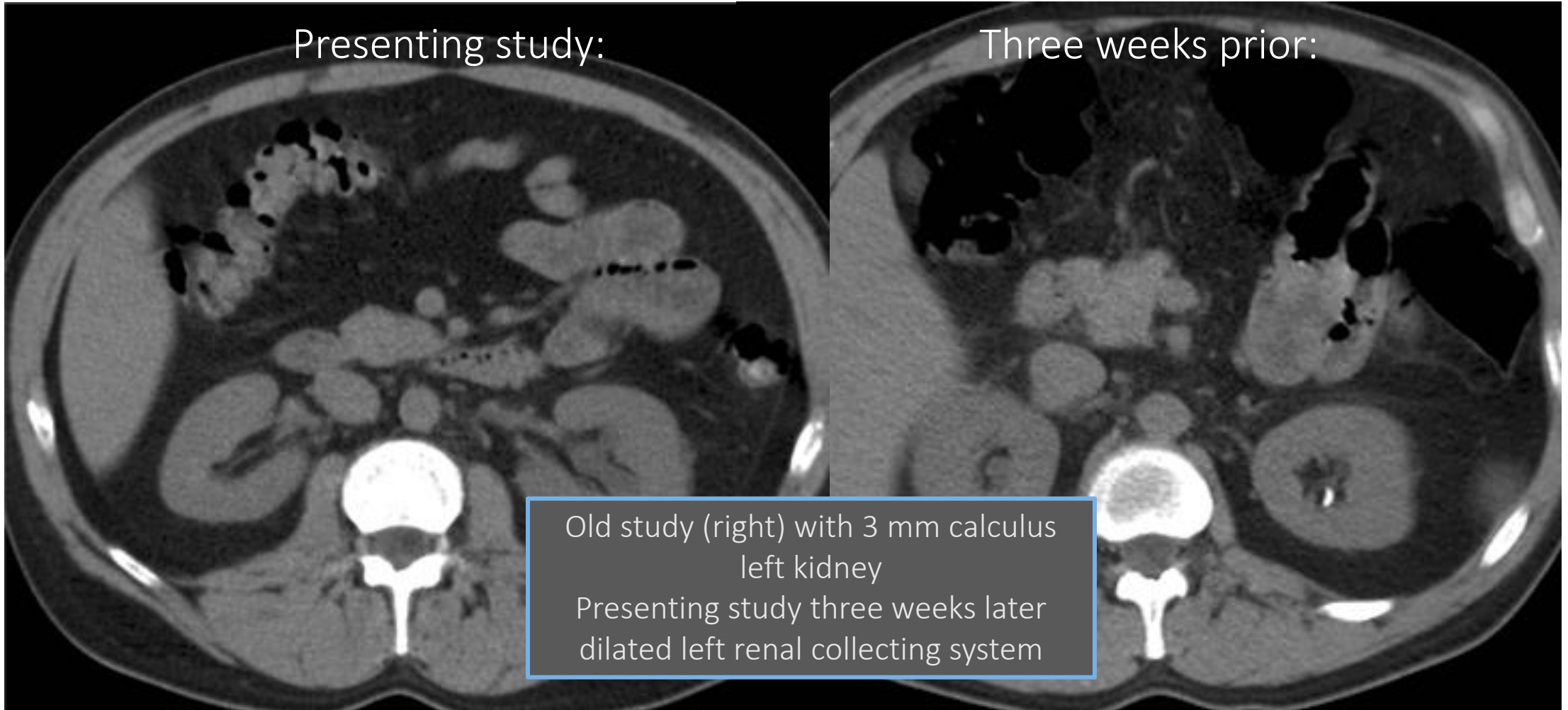


Companion case:
Even on plain films!
Calcified gallstones in pt RUQ (majority
of gallstones are not viz on xray
however)

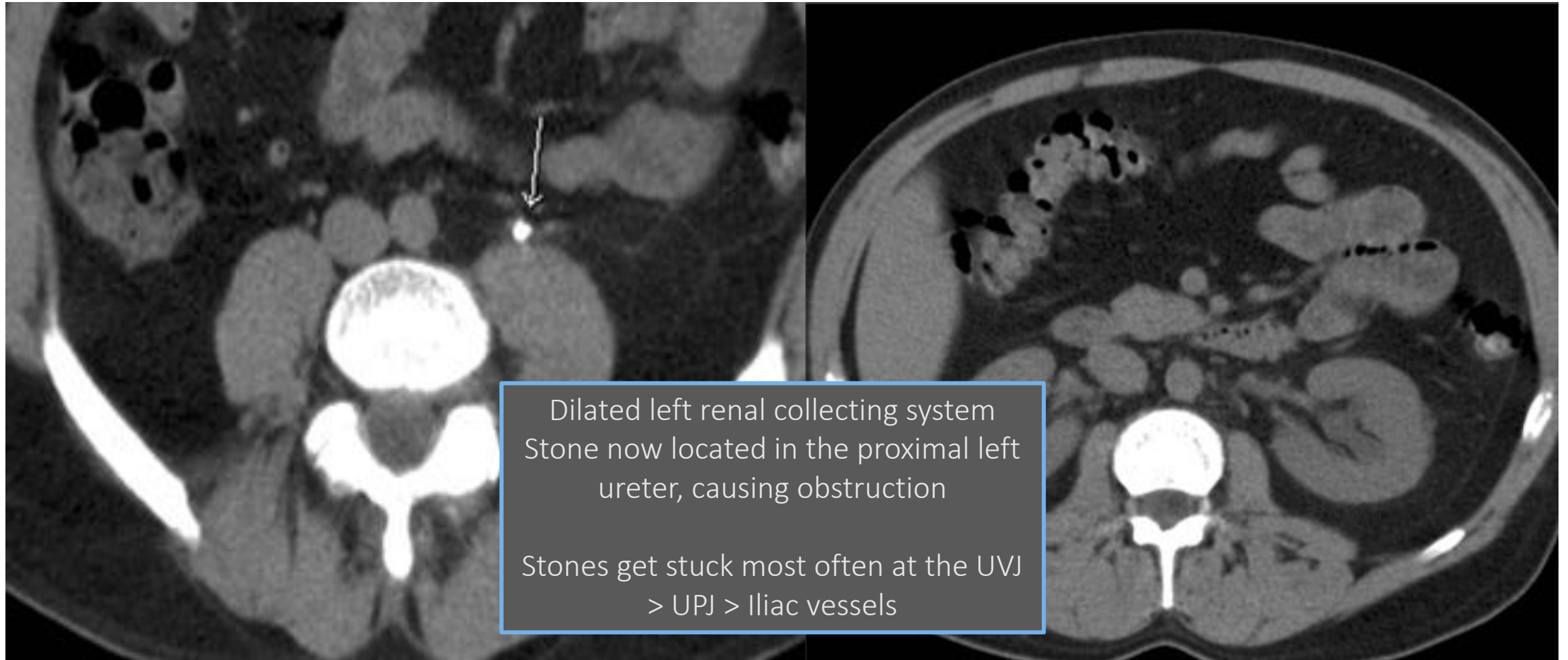
Case 4: Left flank pain

Presenting study:

Three weeks prior:



Case 4: Left flank pain



Case 4: Left flank pain



Nephrolithiasis

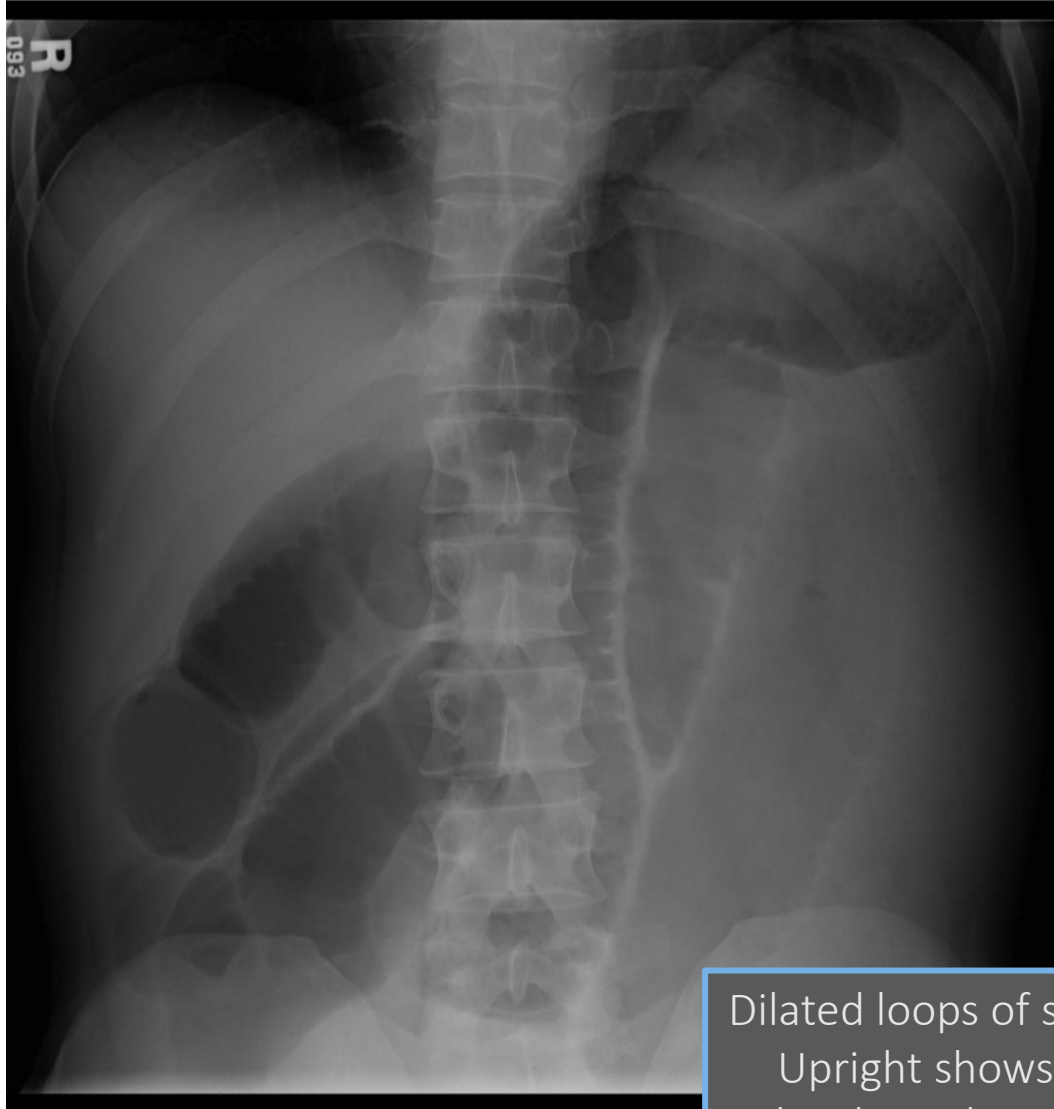
CT is often initial study of choice

US in kids, and radiographs for follow up

Imaging findings:

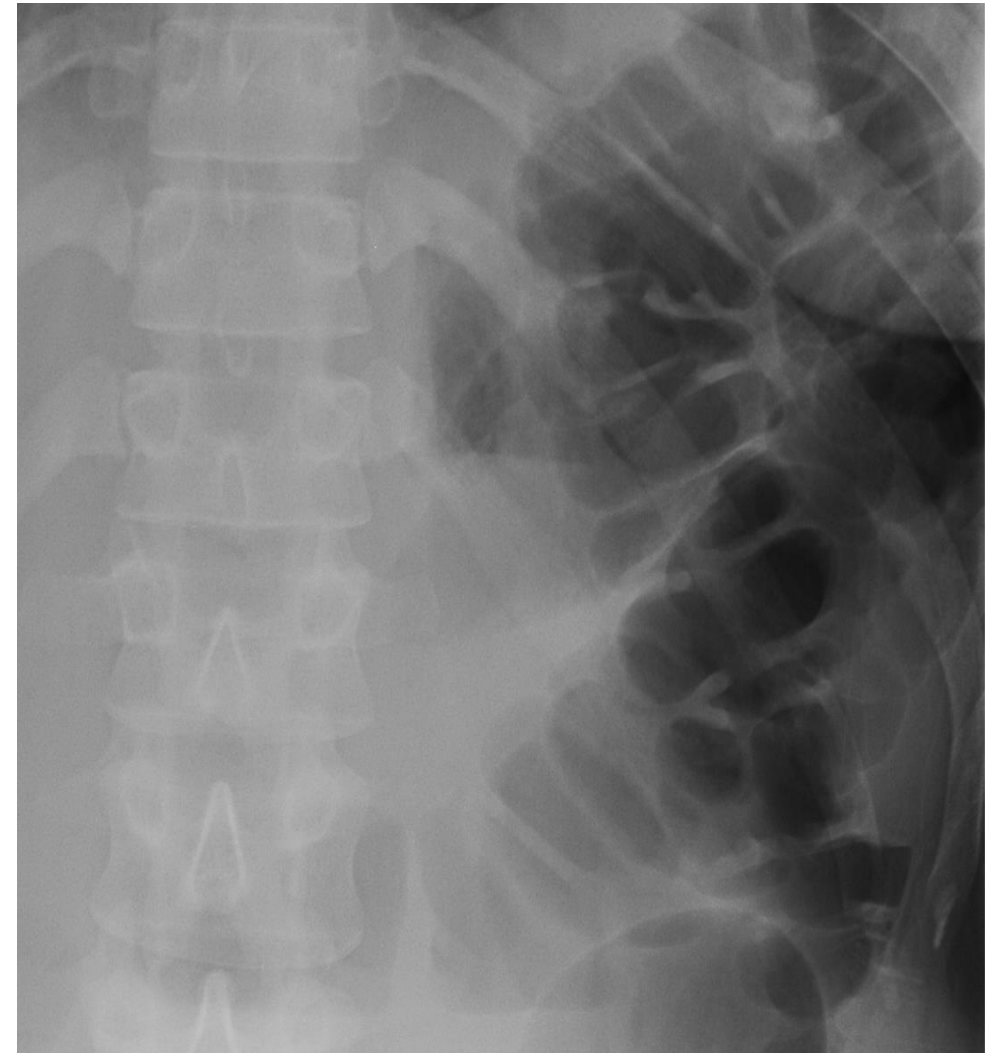
Stone +/-hydronephrosis
dilated ureter, inflammation

Case 5: Vomiting and abdominal distension



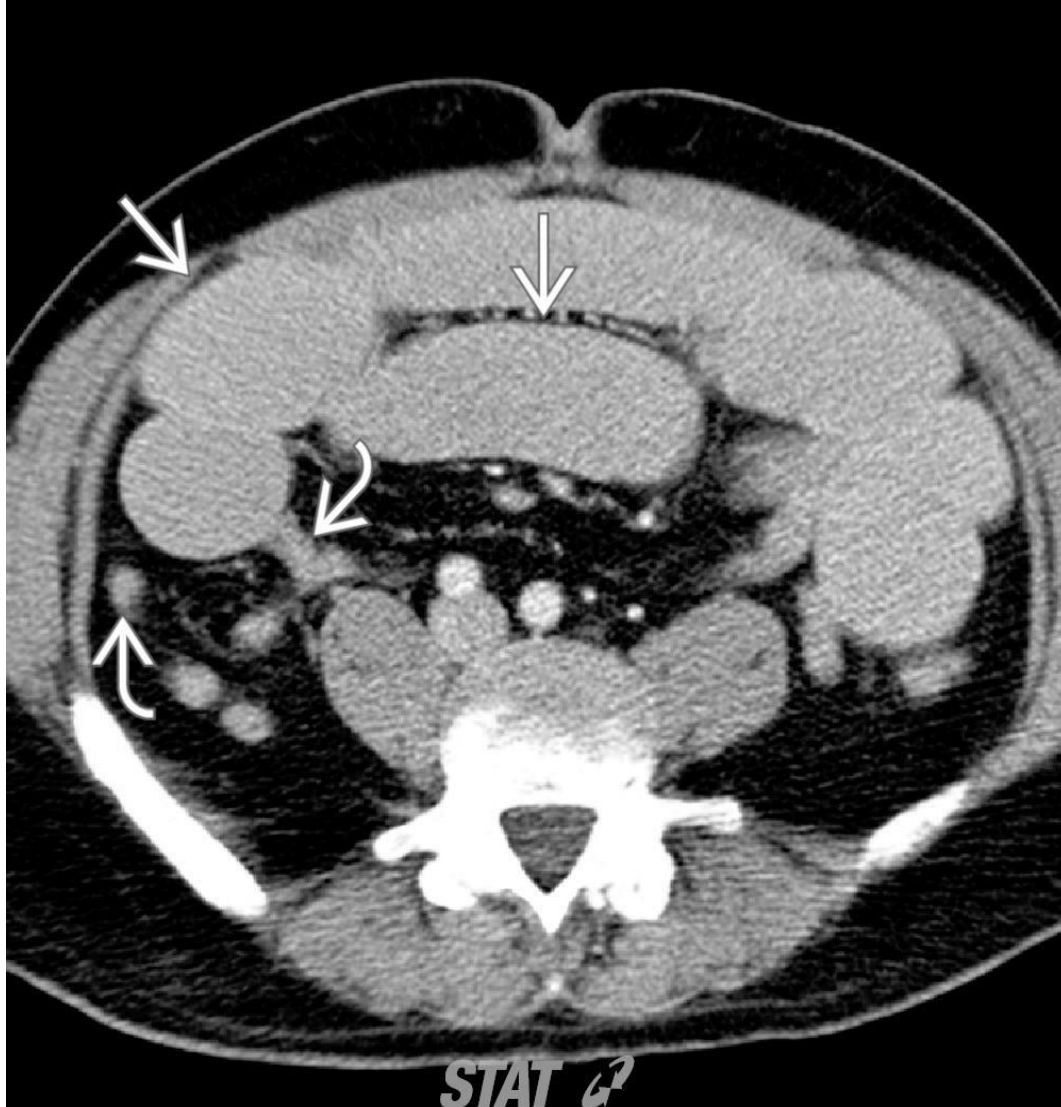
Dilated loops of small bowel on supine.
Upright shows differential air fluid levels, with small bowel dilatation, absence of colon gas/stool.

Small bowel: plicae circulares



Large bowel: haustra

Case 5: Vomiting and abdominal distension



Small bowel obstruction SBO

Imaging findings:

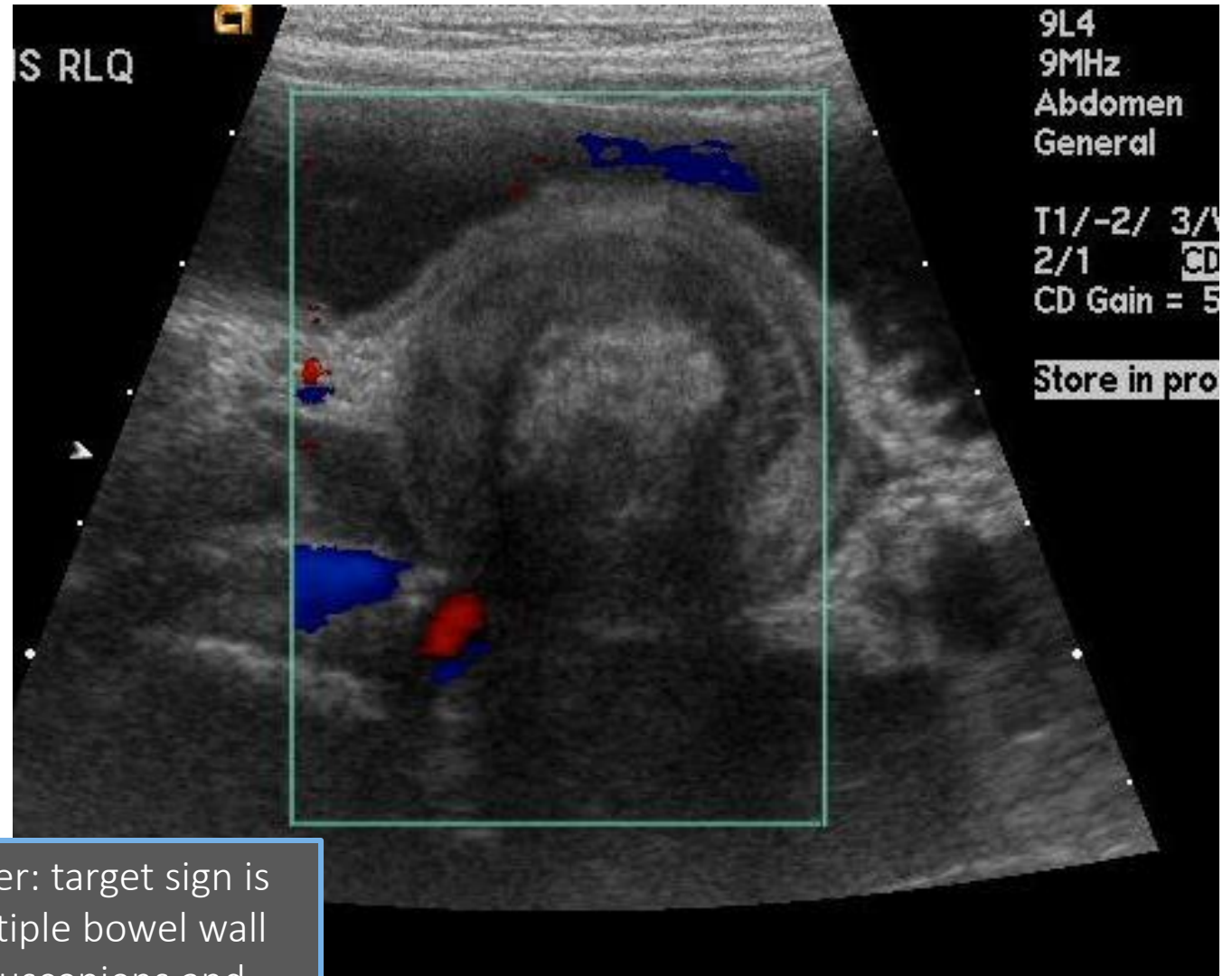
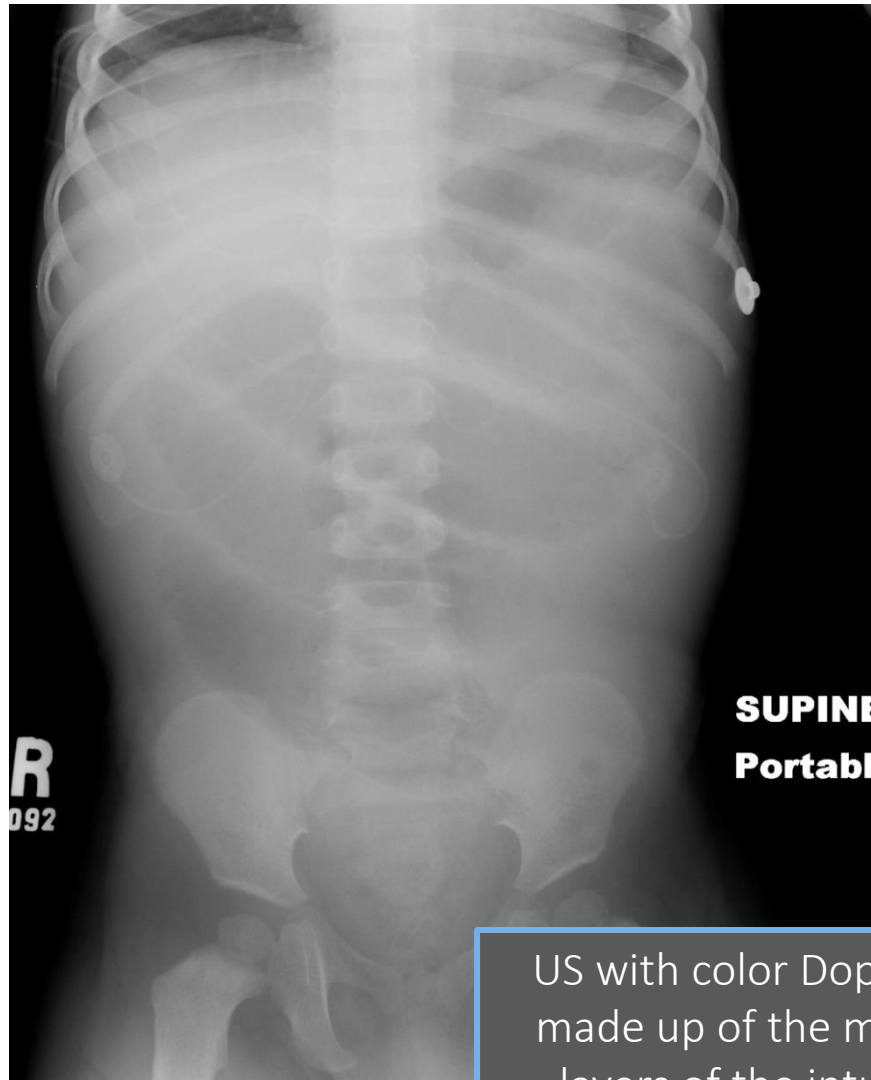
- Dilated loops of bowel, >3 cm

- Air fluid levels

- Decompressed distal bowel and colon

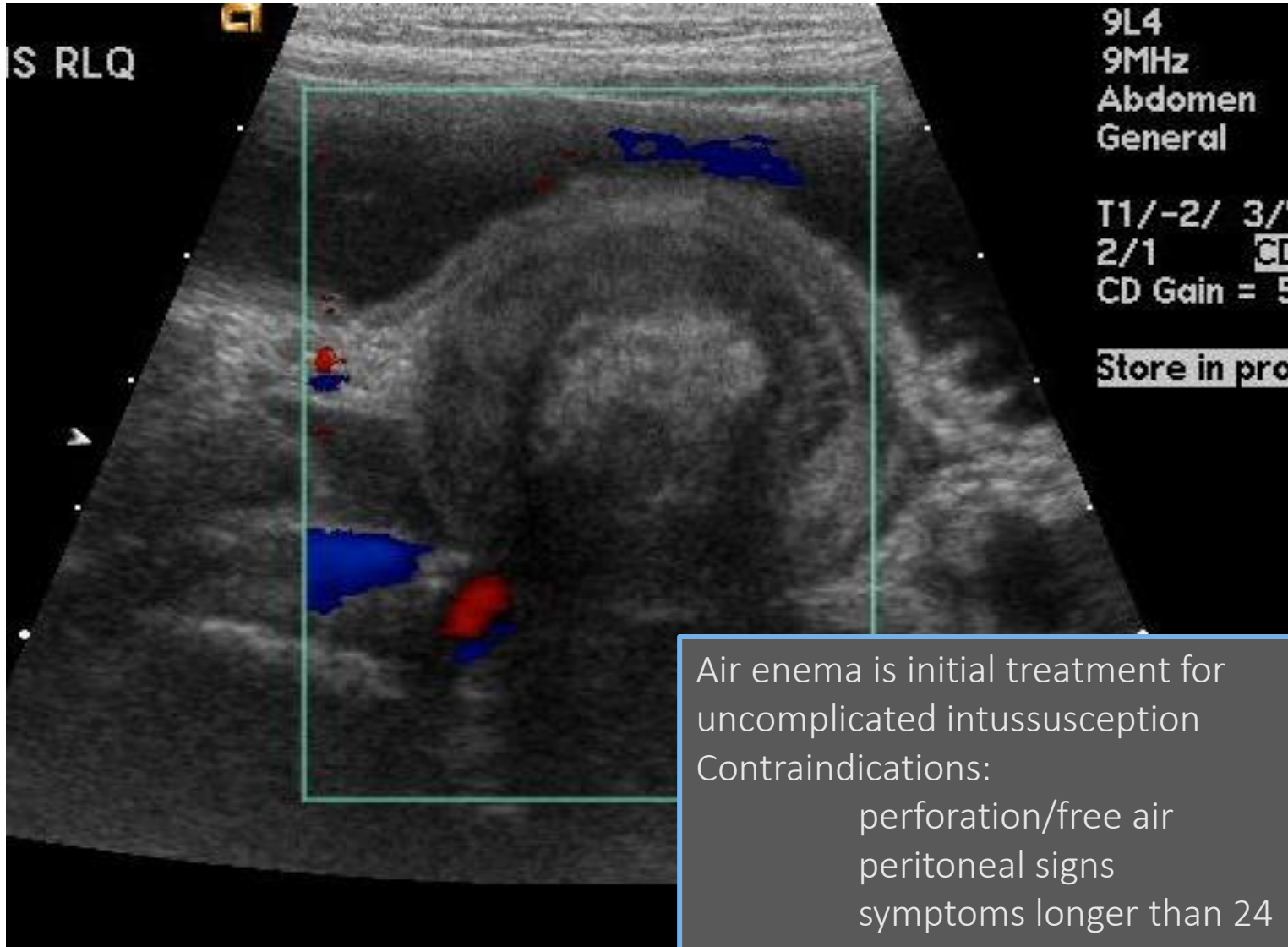
- CT: transition point - hernia, adhesions, mass

Case 6: Currant jelly stool



US with color Doppler: target sign is made up of the multiple bowel wall layers of the intussuscepiens and intussusceptum

Case 6: Currant jelly stool



Intussusception

3 months to 3 years old; US test of choice in kids

Imaging findings:

Obstruction +/- right upper quadrant mass on radiograph

US: target sign

Air enema is initial treatment for uncomplicated intussusception

Contraindications:

perforation/free air

peritoneal signs

symptoms longer than 24

hours

Case 6: Currant jelly stool



Air enema

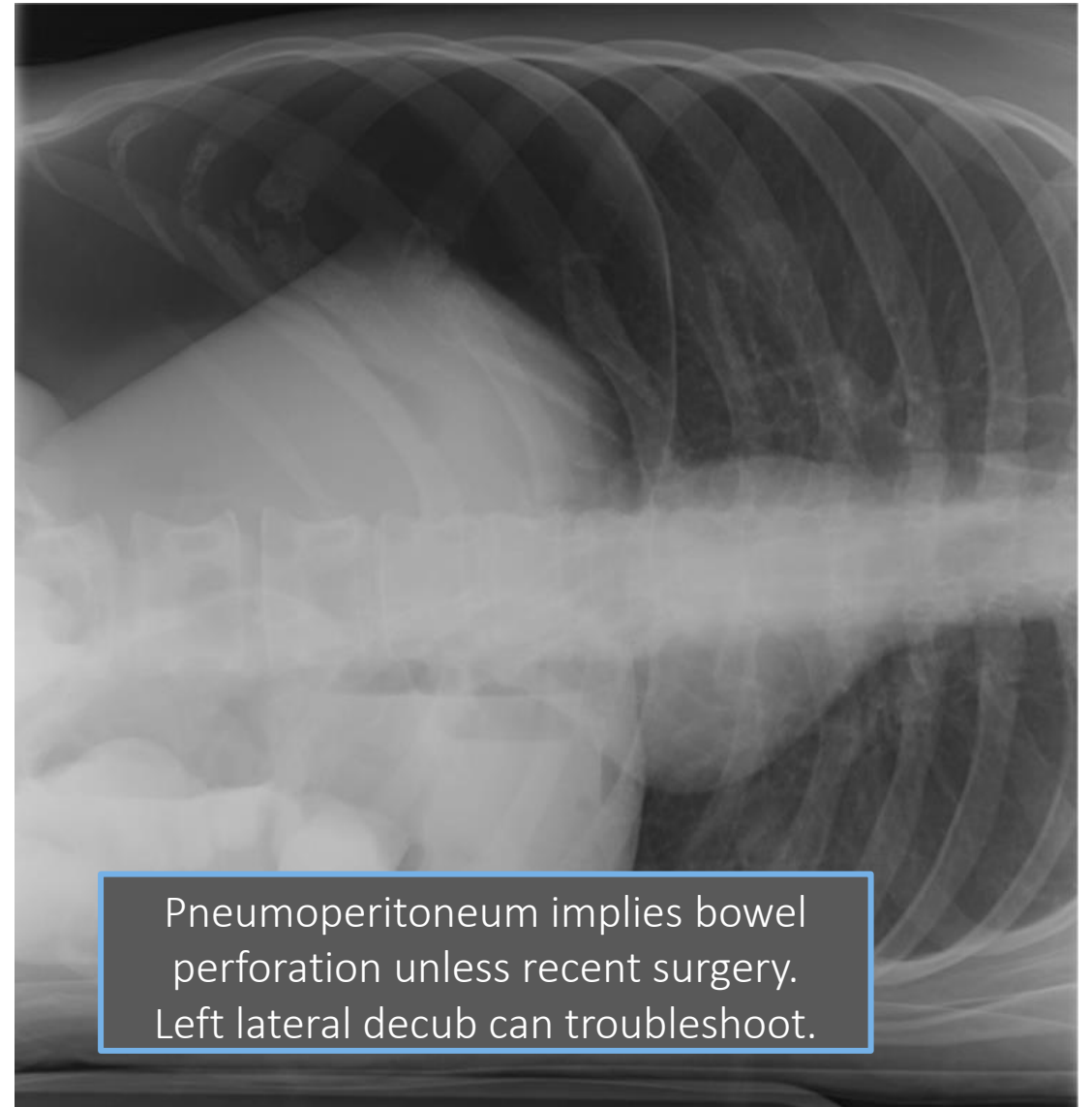
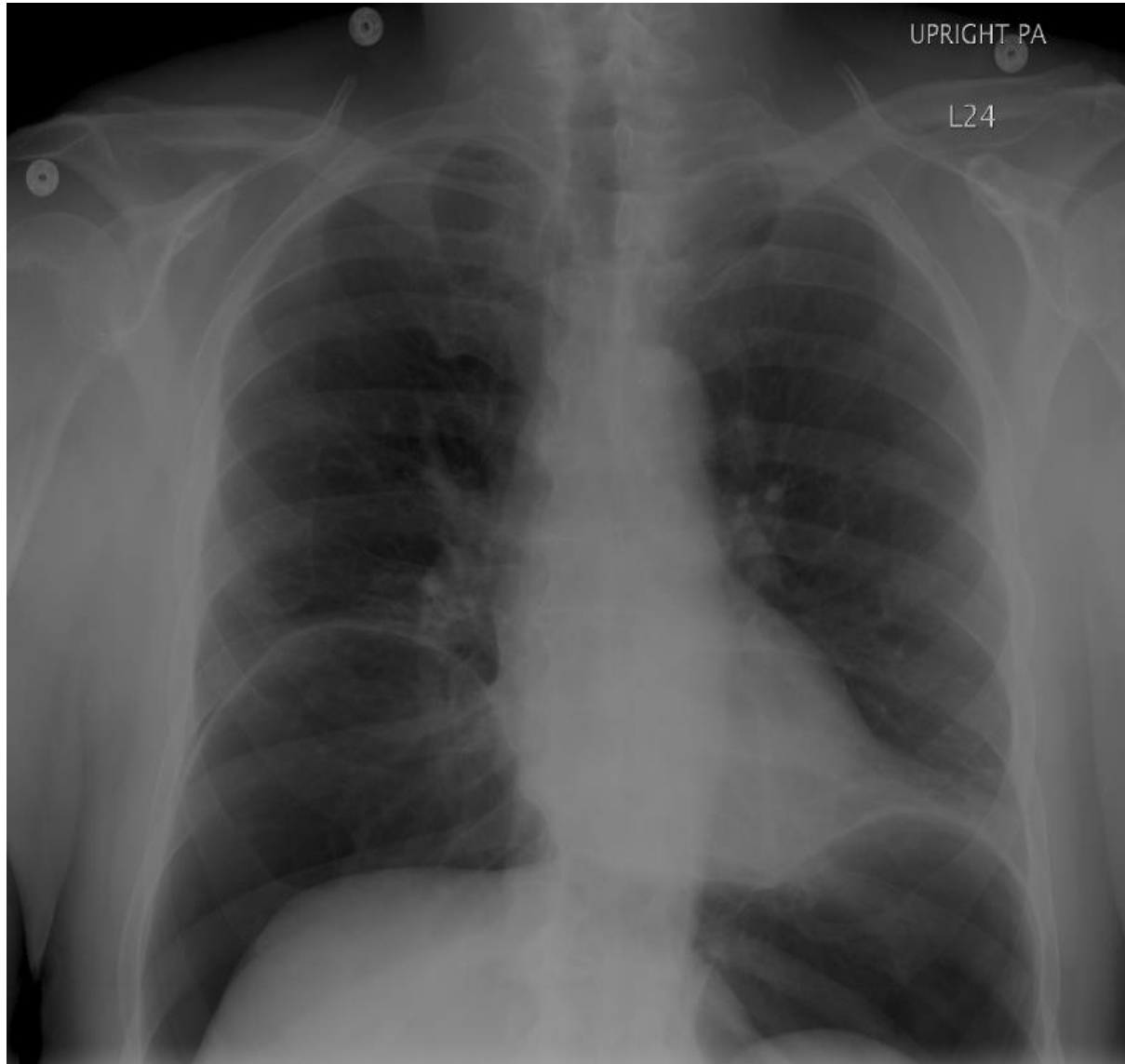
Ileocolic intussusception is treated by radiologists.

Catheter inserted into rectum and taped for seal to prevent air leak.

Pump air into the colon maintaining pressure <120 mmHg until reduced.

Successful reduction – will see air reflux into the distal small bowel.

Case 7: Pain



Case 8: Obtundation with hypotension



Axial CTs: Diffusely dilated loops of bowel. Air in the bowel wall = pneumatosis. Air in the SMV at the portal confluence

Case 8: Obtundation with hypotension



Axial CTs: Diffusely dilated loops of bowel. Air in the bowel wall = pneumatosis.

Ischemic bowel with pneumatosis

Imaging findings:

Bowel wall thickening

Pneumatosis is often late finding

Gas in dependent bowel wall

Can see gas in SMV/portal veins

Think Back !

- Common causes of abdominal pain we image
- Remember: US in children, radiographs/CT in adults
- But US in gallstones and cholecystitis!
- CT WITH contrast unless contraindication or suspect renal stone
- Intussusception Rx - air enema
- Any others? Any questions?


Welcome to the UNC Radiology Residency Education Website!

UNCRADRES

Tweets by @UNCRadRes

UNC Rad Residency @UNCRadRes

Neuroradiology resident field trip to the art museum to check out the beautiful brain art. #RadioActivity @THMMD @DavidMauroMD @SJordanMD



We had a blast presenting all of our work at #SIRATX19! Thanks to @UNCRadiology for the opportunity. #RadioActivity @BDixonMD @JessieStewartMD @mcbreamy @CharlesBurkeMD @SJordanMD @THMMD

Embed View on Twitter

We are pleased to provide this educational resource for our residency program!

UNC Rad Q&Genda, subspecialty block ed resources, Phone Numbers, HSL custom build e-books, helpful hints can be found on this site.

ABR Core exam intel

Block 10 Schedule

Chief's Survey

RadExam


RSNA Physics Modules

UNC Radiology Conference schedule 18-19

Today March 2019

Sun	Mon	Tue	Wed	Thu	Fri	Sat
24	25	26	27	28	Mar 1	2
	7am Cardiac Cases - 12pm Body: US Reni	7am Hot Seat - Phys 8am CVI Family Med 12pm Breast - Kuzm	12pm Health Care Ec	7am Hot Seat - Phys 12pm Neuro - Pediat	12pm Radiology Jour	
3	4	5	6	7	8	9
	12pm Body: Modern	7am Hot Seat - White 12pm VIR: Yu - Dialy	12pm Peds Interactiv	7am Hot Seat - White 12pm MSK: Maetani	12pm Chest: Sakthiv	
10	11	12	13	14	15	16
	7am Chest Cases - E 12pm Body: HSG - C	7am Hot Seat - Phys 8am CVI Family Med 12pm Resident Conf	12pm Body: Solid an	7am Grand Rounds - 12pm NM: Oldan - N	12pm Neuro - White	
17	18	19	20	21	22	23
	12pm Body: MRI/MR	7am Hot Seat - Core 12pm VIR: Dixon - R	12pm Peds: Fordhan	7am Hot Seat - Core 12pm MSK: Nissman	7am Grand Rounds: 12pm MSK: Robert J	
24	25	26	27	28	29	30
	7am Chest Cases - E 12pm Body: US Live	7am Hot Seat - Core 8am CVI Family Med 12pm Breast - Fellow	12pm Fellow Panel:	7am Hot Seat - Core 12pm Neuro - Neuro	12pm Cardiac Hyslop	

Home



Welcome to our UNC Medical Student Radiology website!

Custom built HSL website for Radiology - e-Anatomy, UpToDate, PubMed and reference books

UNC Radiology Teaching Files

URMC Radiology Teaching Files

ACR Appropriateness Criteria: What Test Applies?

Department career goal advisers are available to counsel radiology-bound students!

RADY Formal Didactic Curriculum

Today February 2020

Sun	Mon	Tue	Wed	Thu	Fri	Sat
26	27	28	29	30	31	Feb 1
	10am RADY 401 Cas 1pm Intro to VIR Dr	2pm Best of Breast 4pm Ms Click Sum L	1pm Meet Aunt Minn		TEC Block 11 Ends 10am RADY 401 Fin	
2	3	4	5	6	7	8
	TEC Block 12 begin 11am RADY 401 Intr	RADY Symposium 8am Intro and Apprc 9am CXR #1 in the 10am Emergency Ra 11am Head CT Dr Rc	1pm Intro to Cardio;	1pm CXR Unknowns		
9	10	11	12	13	14	15
	1pm Intro to Abdom 2pm Approach to the	RADY Symposium 8am Cervical spine C 9am Body CT Dr Des		1pm Intro to Muscul	10am RADY 401 Mid	

More at www.rads.web.unc.edu www.msrad.web.unc.edu and @UNCRadRes

Thank you!

References

Birchard KR, Busireddy KR, Semelka RC. Critical Observations in Radiology for Medical Students. John Wiley & Sons; 2015.

Barclay L. Evaluation of Acute Abdominal Pain Reviewed. Medscape. <https://www.medscape.org/viewarticle/573206>. Published April 18, 2008. Accessed March 30, 2019.