



Body CT

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UNC Radiology Residency Educational Scholarship

University of North Carolina School of Medicine  
Department of Radiology 2020

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# Learning objectives

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

- I. Describe basic of CT to include common indications for body CT
- II. Identify basic abdominal CT anatomy
- III. Recognize classic CT cases

# Outline

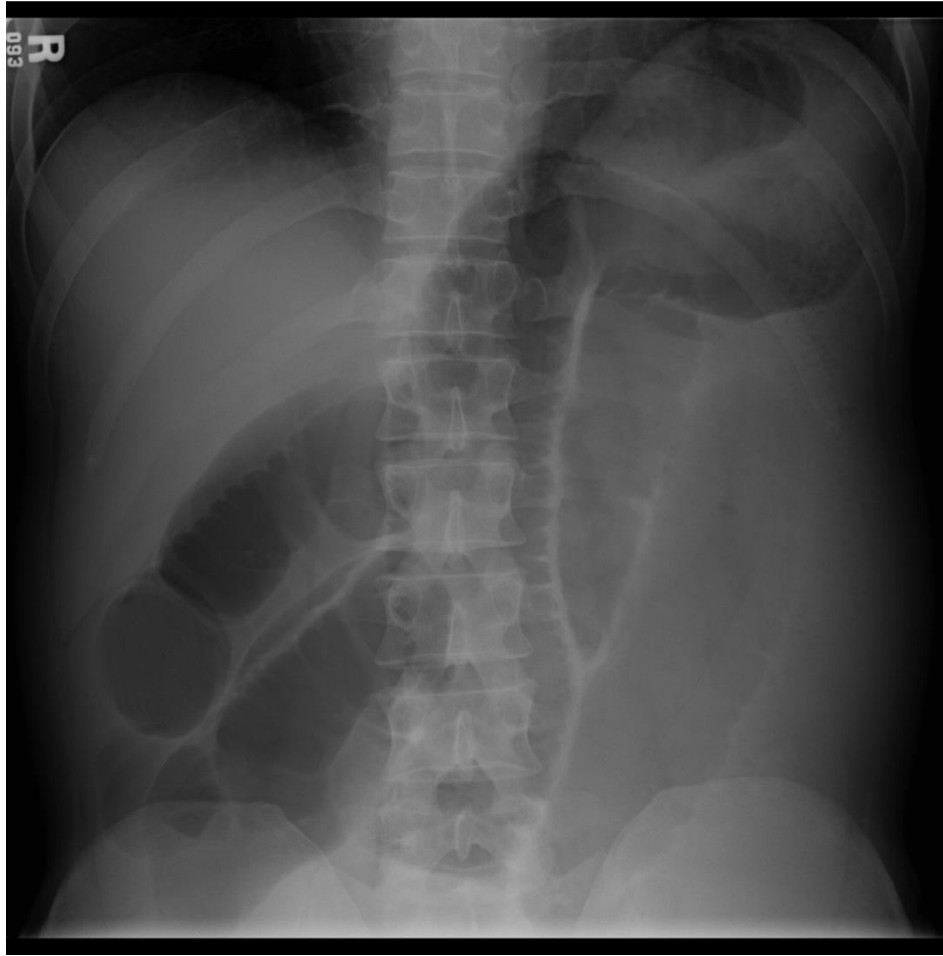
1. Think Back
2. Basics & Indications
3. Abdominal CT Anatomy
4. Cases
5. Wrap Up/Questions

## Think Back Q1

When you suspect acute cholecystitis, what imaging test should you order?

Correct! GB ultrasound

# Think Back Q2



Supine

What is the diagnosis?

Correct! Small bowel obstruction

Erect



## Think Back Q3

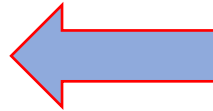
When would you order MRI as the first line study for abdominal pain?

Correct! Suspected Appendicitis in a pregnant woman!

# Outline

1. Think Back

2. Basics & Indications



3. Abdominal CT Anatomy

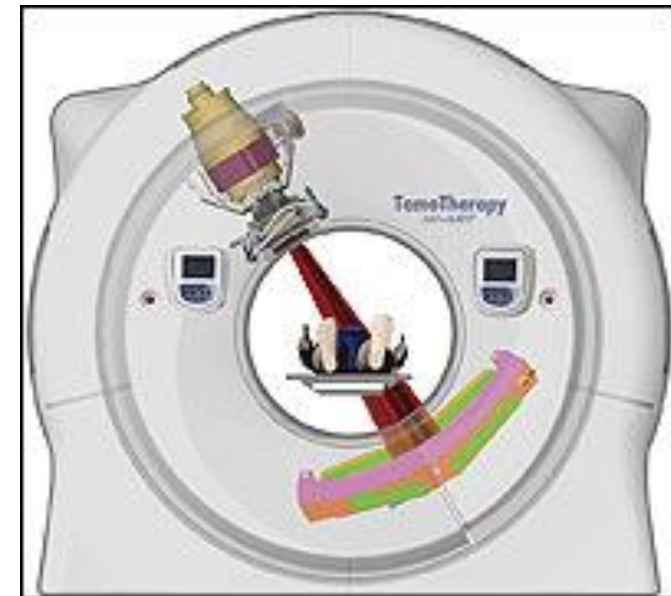
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# CT Basics

Ionizing radiation (x-rays)

Basically CT is an x-ray tube that rotates around the patient with detectors on opposite side





# CT Basics

## Multidetector

- 8, 16, 64, 128, 320 rows of detectors
- 64-slice scanner = 64 detector arrays in 40 mm width = 0.6 mm slice thickness
- Faster scans than single row
- More detectors helpful for breath hold studies, non-cooperative patients, and cardiac imaging

Pros: Fast and High detail

Cons: Radiation, Contrast reactions, and Expensive

# CT Basics - Contrast

## Types of CT Scans

- CT with Contrast
  - IV and PO Contrast (More Later!)
- CT without contrast
- CT Angiography (CTA)

Pearl: Never order a CT with and without: limited indications to do so.  
Plus, we must then call you / you will be interrupted in your daily tasks

# CT Basics - Contrast

## WHAT IS CONTRAST?

IV and PO administered and used to highlight organs

Allows better visualization, differentiates structures

CT contrast is iodine based

Ex: omnipaque 350

## ORAL CONTRAST OMNIPAQUE 240

Water soluble, safe in case of bowel perf

Include oral contrast in nearly all standard CT AP exams

Exceptions: retroperitoneal and vascular studies

# CT Basics - Contrast

## ALLERGIES

### Contrast allergies

Hives/rash

Laryngeal edema

Bronchospasm

Vasovagal (not really an allergy)

True anaphylaxis

**Note:** True anaphylaxis from prior contrast is **CONTRAINDICATION** to **EVER** receiving contrast again!

## PREMEDS

### Contrast allergy premedication

At UNC:

50 mg po prednisone 13, 7, 1 hour prior to study

25-50 mg po benadryl 1 hour prior

### Reasons to premedicate:

Severe hives

Edema

Bronchospasm

## Contrast Myths

Shellfish Allergy is not a contrast allergy!

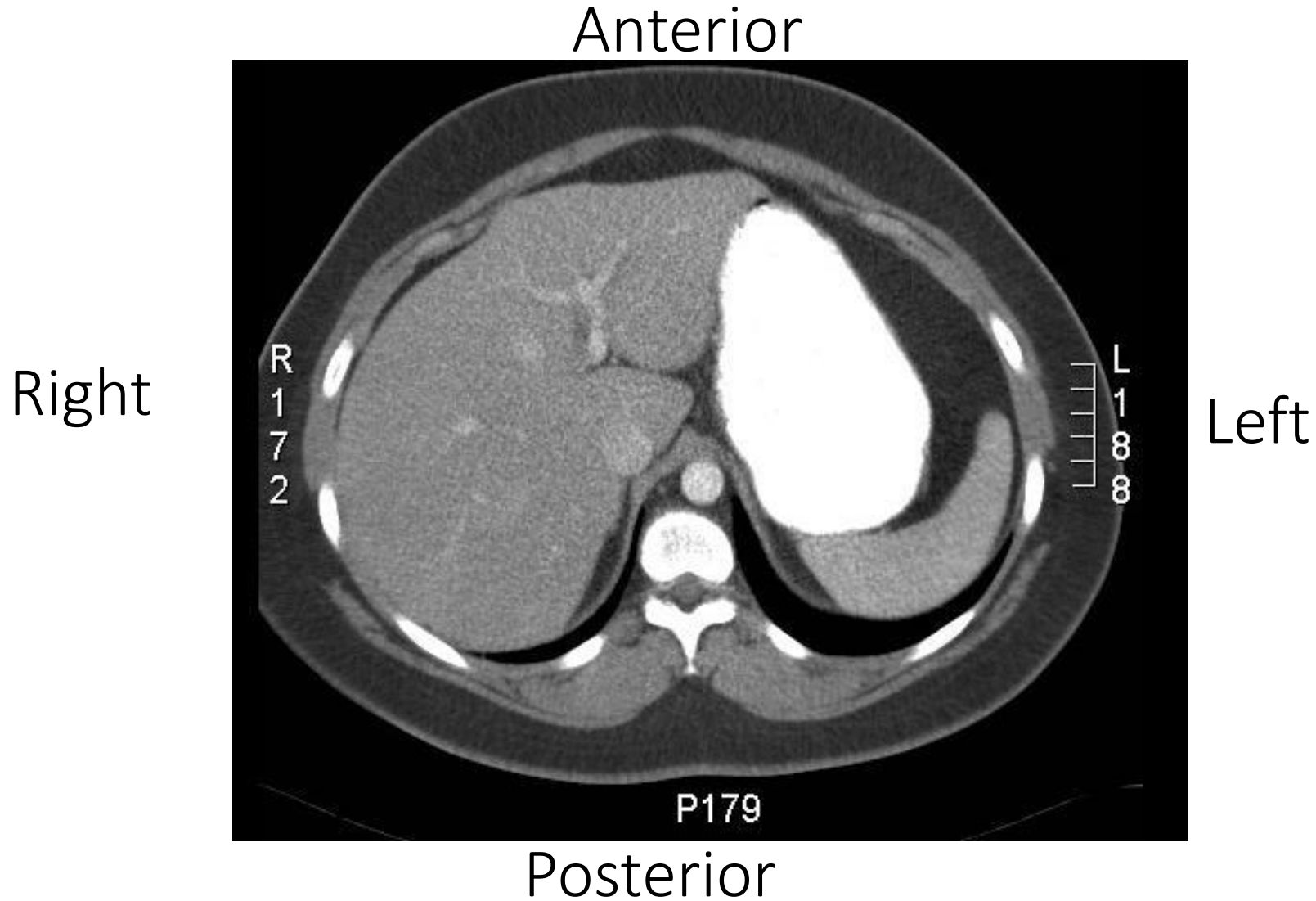
'Iodine allergy' or topical iodine

Iodine is an essential substance

Present in thyroid hormone

# CT Basics - Anatomy

3 Planes may be included: Axial (or transverse), Coronal, and Sagittal. For body work, axial and coronal are today's scan hallmarks (prev axial)



# CT Basics - HU and Window-Level

## HOUNSFIELD UNITS

Water = 0 HU

All other densities relative  
to water

Air -1000

Lung -600 to -400

Fat -100 to - 40

Soft tissue 40 to 80

Bone 400 to 1000

## WINDOW & LEVEL

Window and Level: allow for  
tissue contrast

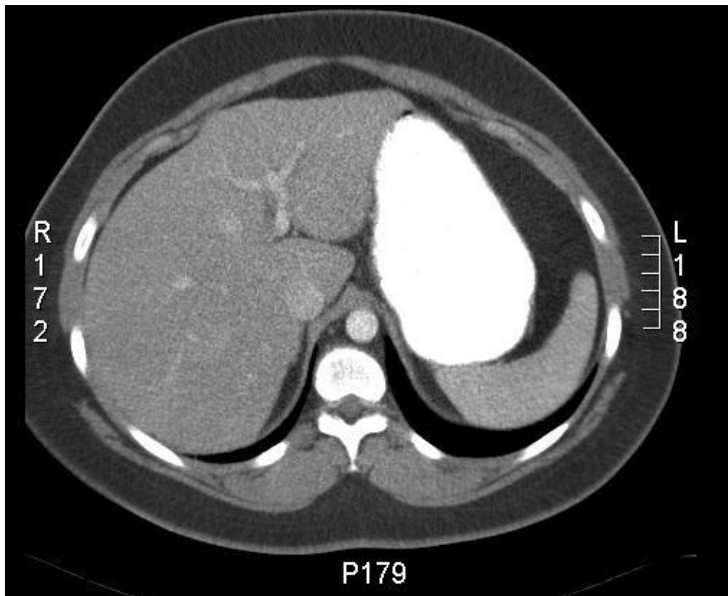
Window width = width of  
values

- Depends on the area of  
interest on the scan (lung and  
bone are not the same!)
- Ex: bone windows: 3000

Level = set point

Ex: bone level: 500

# CT Basics - Window Settings



Soft tissue/  
Vascular

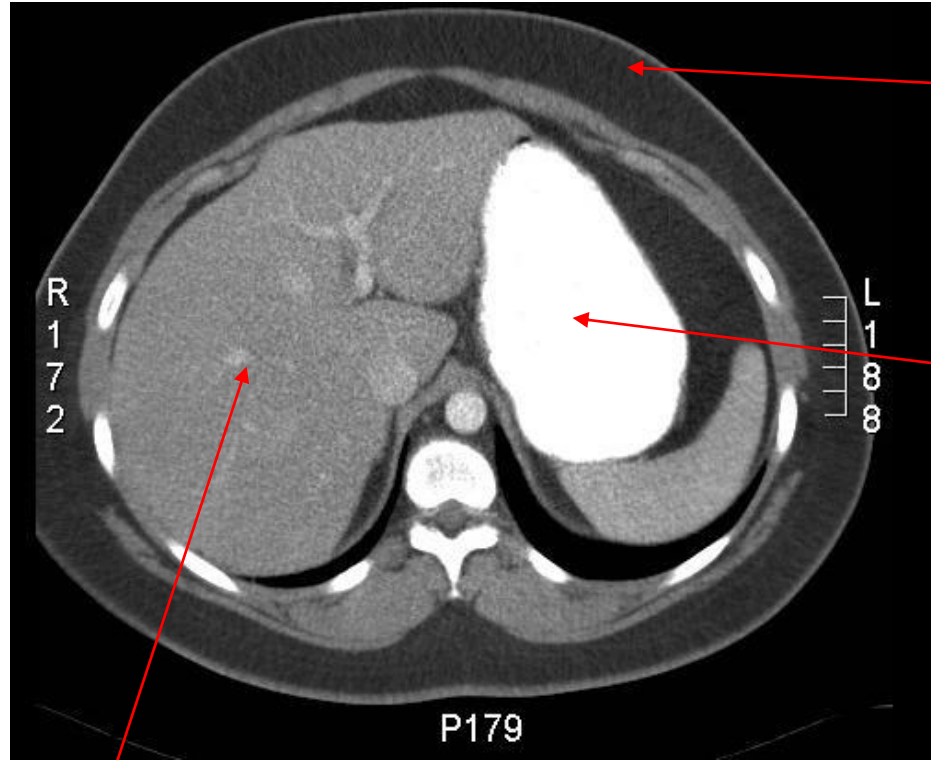


Lung



Bone

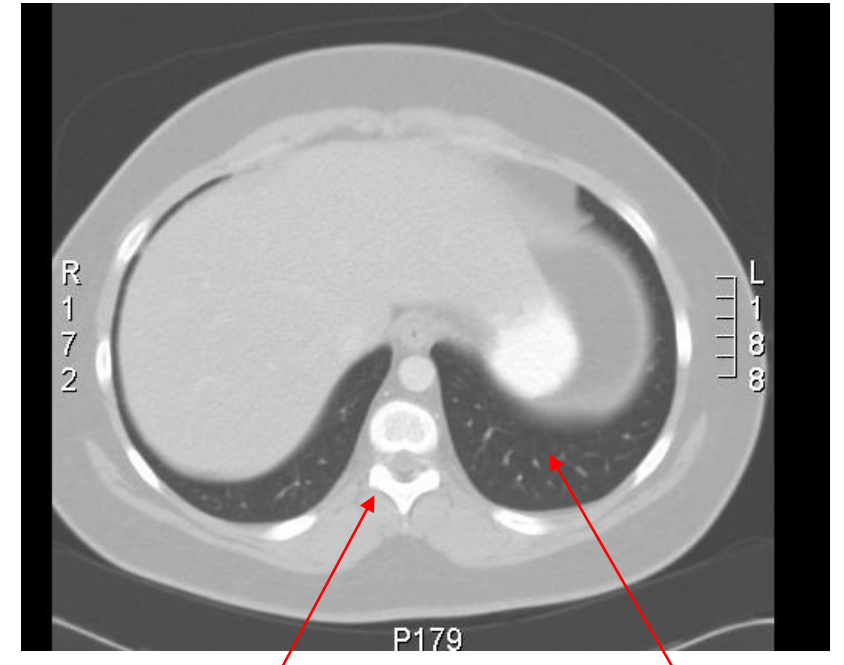
# CT Basics - Densities



Soft tissue

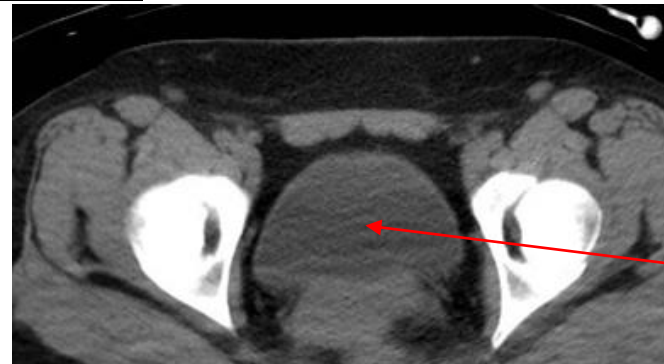
Fat

Contrast



Bone

Air



Fluid



# CT Basics - Radiation Dose

Annual background radiation

3 mSv

CT Effective Doses

10 mSv for AP (3 years background)

5-6 mSv for chest only (1.5-2 years background)

1.5 mSv CT chest lung cancer screening

12 mSv coronary CTA (4 years background)

# CT Basics - Indications

Trauma

Pain

Mass

Cancer staging & surveillance

Pre & post operative

Complications

**AND SO MANY MORE . . .**  
**Think back to our Emergency  
Radiology and Abd Pain Lectures!**

# CT Basics - Order Entry

How to order in EPIC

CT abdomen and pelvis W contrast

CT abdomen and pelvis WO contrast

CT chest WO contrast

CT chest W contrast

CTA chest W contrast

CT abdomen and pelvis WO contrast renal colic

CT urogram

CT renal mass

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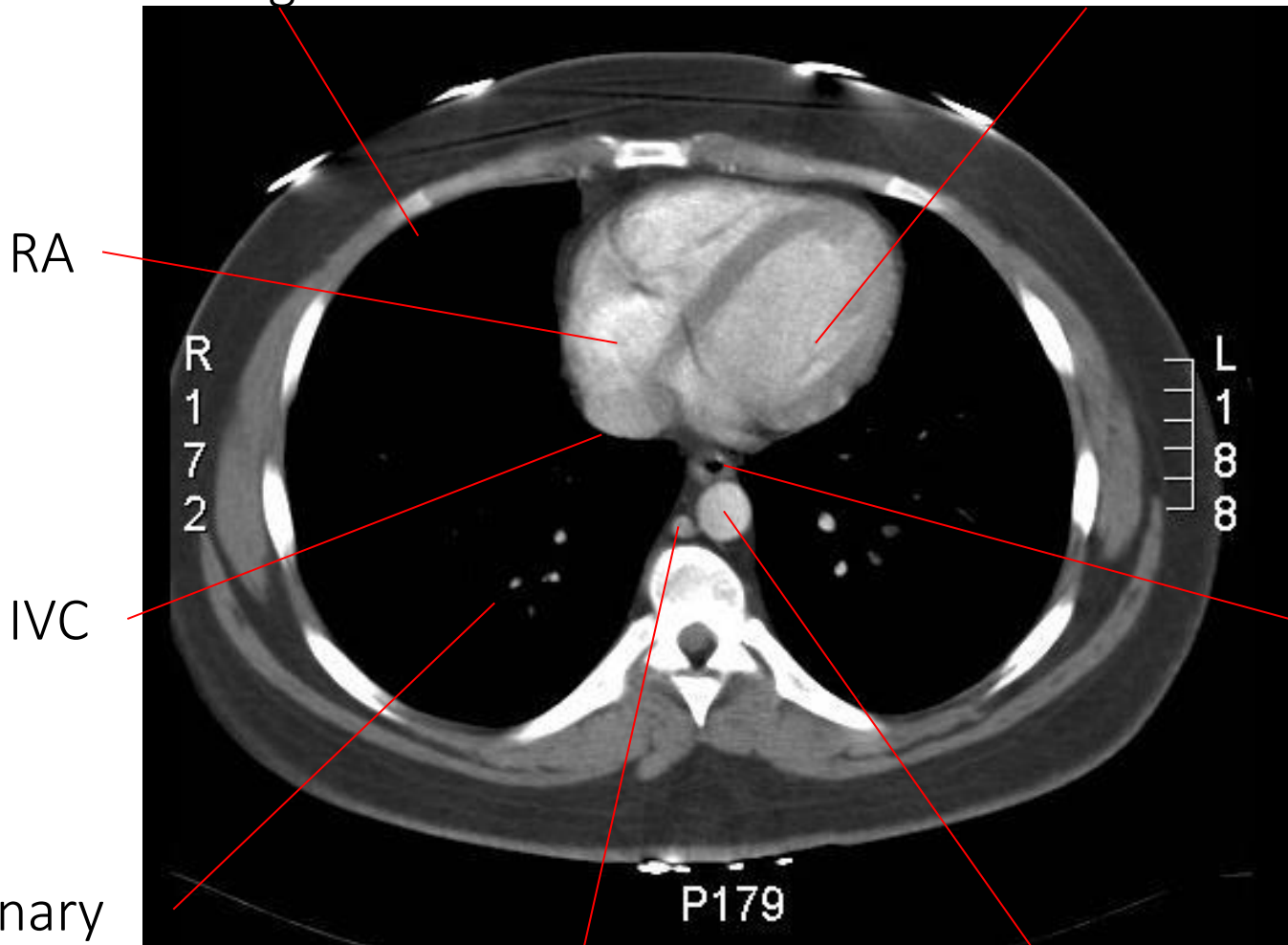
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# CT Basics - Axial Anatomy

R Lung Heart, LV

By convention, CT displayed as if you are standing at the foot of the supine pt – with pt right on left side of screen and pt left on right side of screen



RA

R  
1  
7  
2

L  
1  
8  
8

IVC

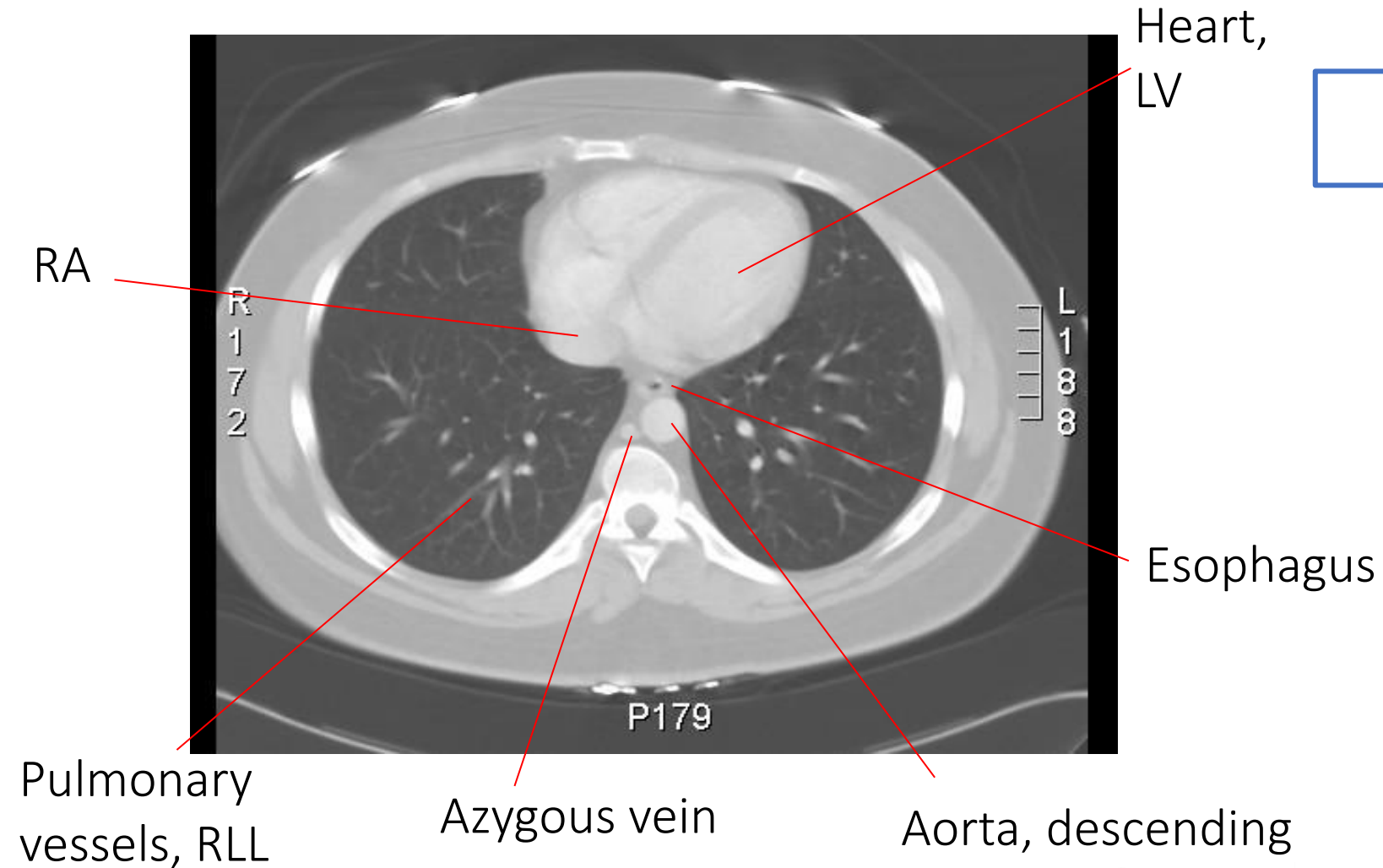
Esophagus

Pulmonary  
vessels, RLL

Azygous vein

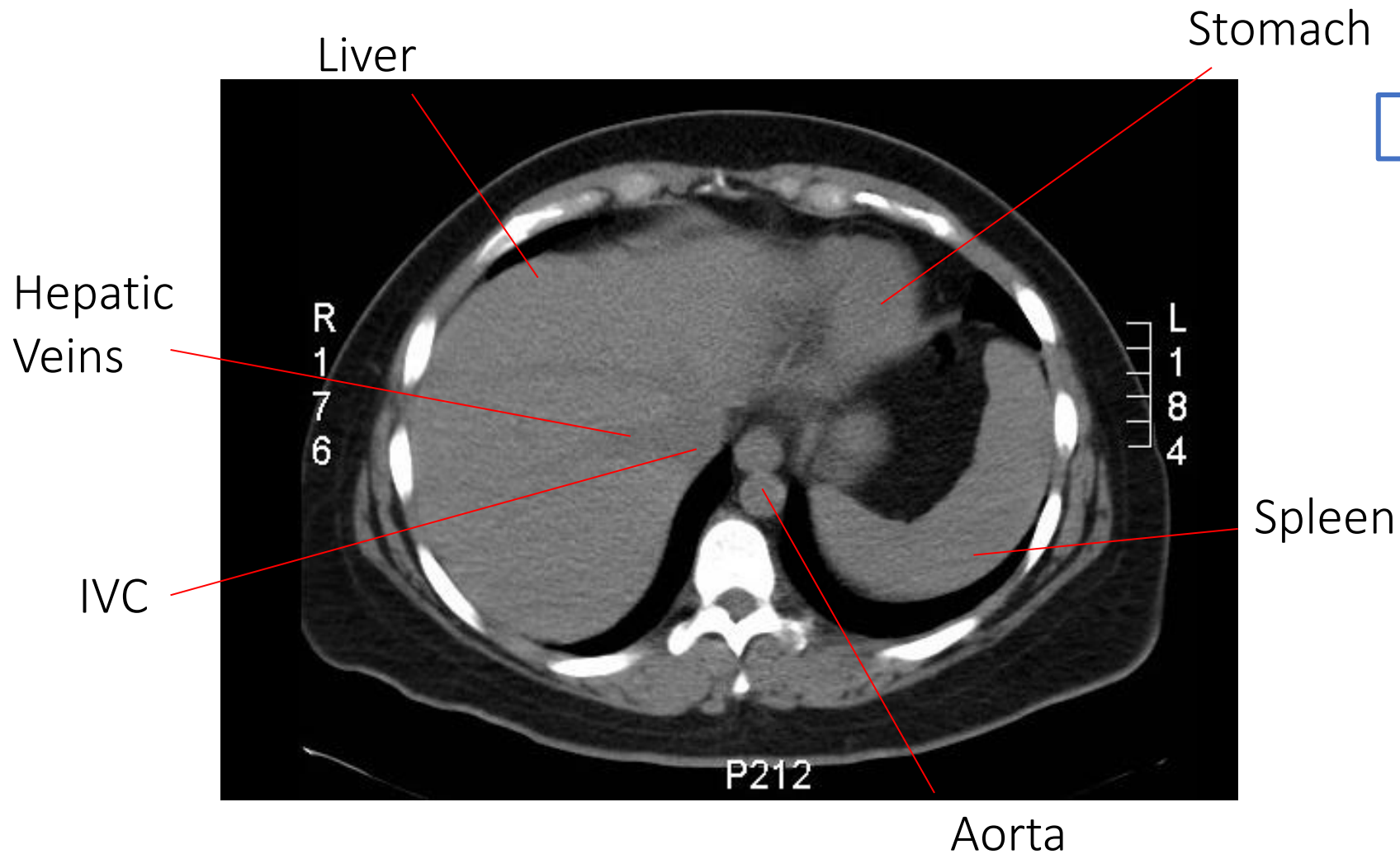
Aorta, descending

# CT Basics - Axial Anatomy



Lung windows for basilar pulmonary findings

# CT Basics - Axial Anatomy



Without IV, PO contrast

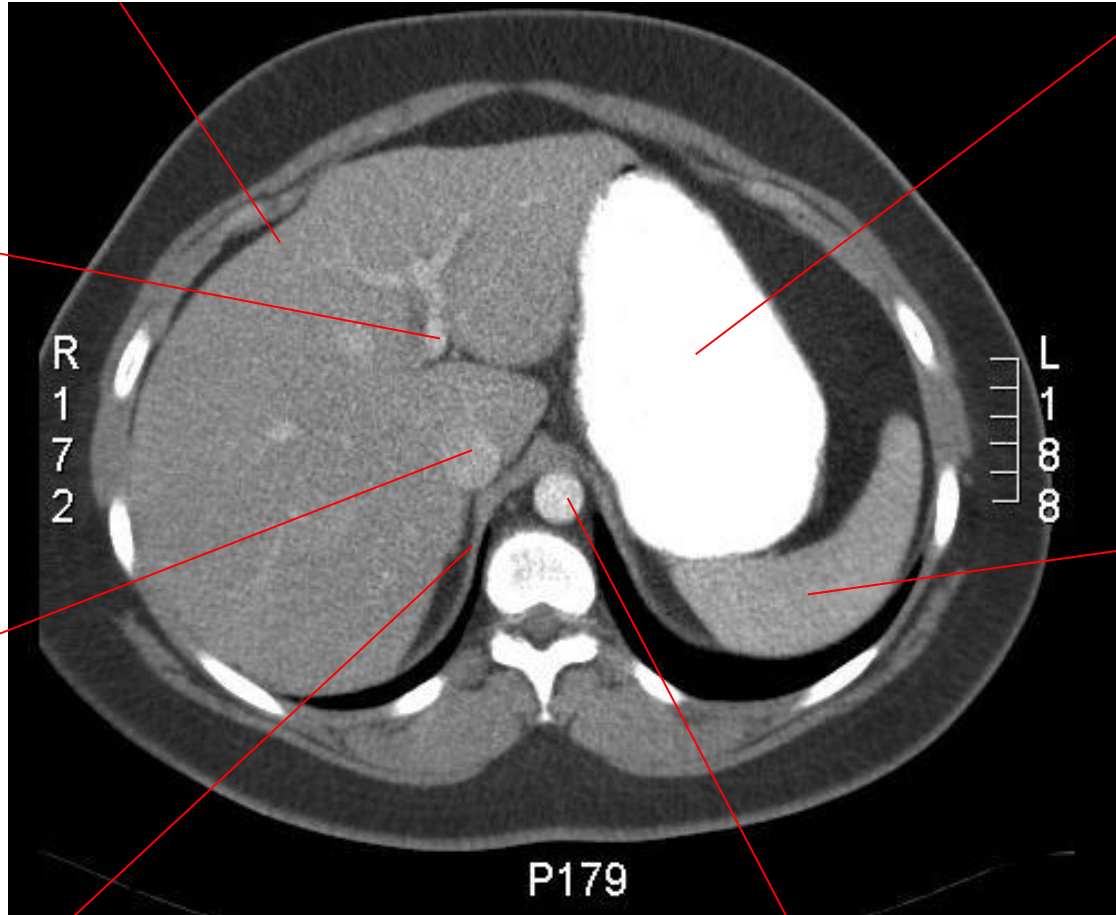
# CT Basics - Axial Anatomy

Liver

Stomach

w/ PO contrast

With IV, PO contrast



Portal Veins

R  
1  
7  
2

L  
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8

IVC

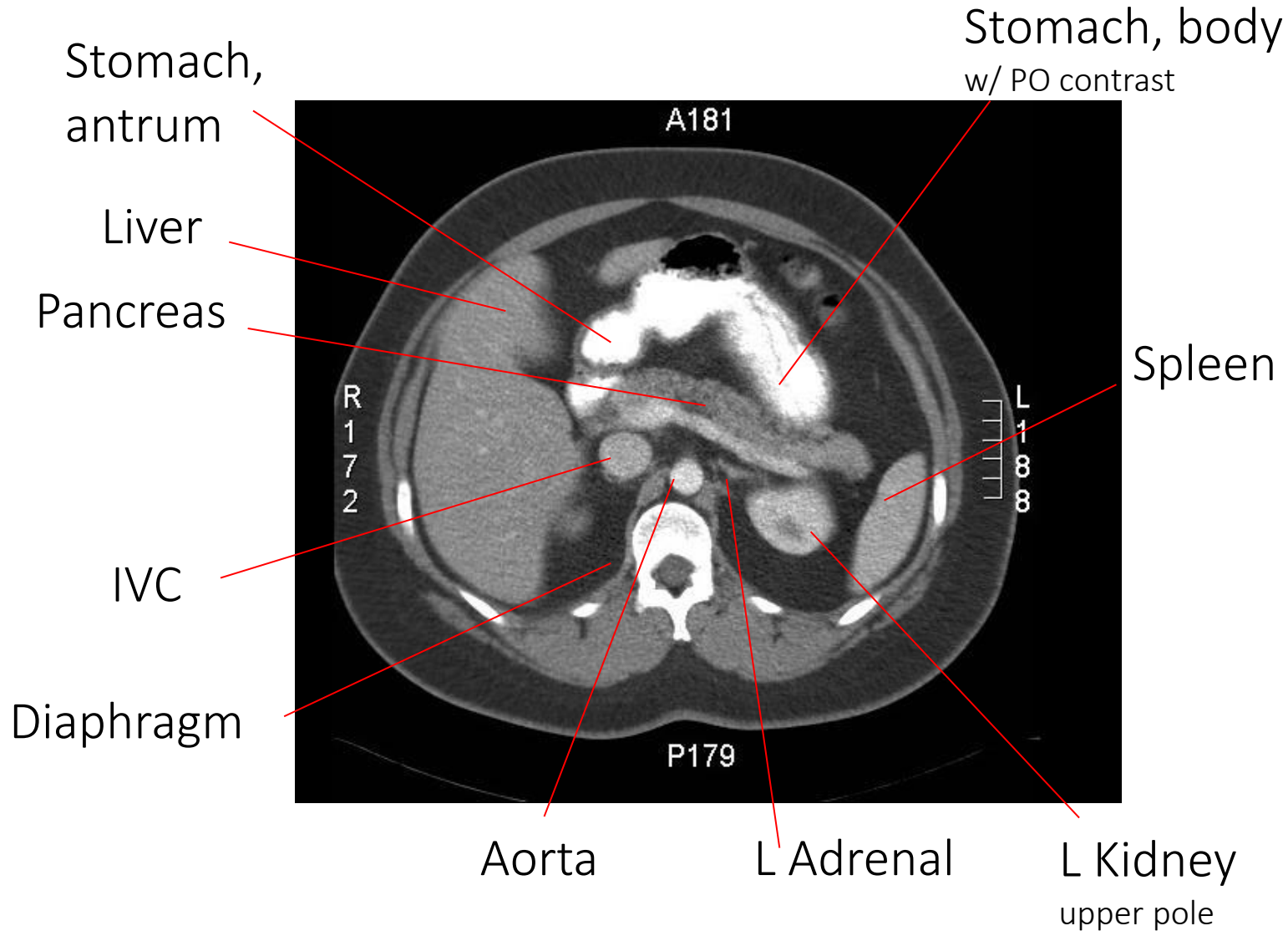
Spleen

Diaphragm

Aorta



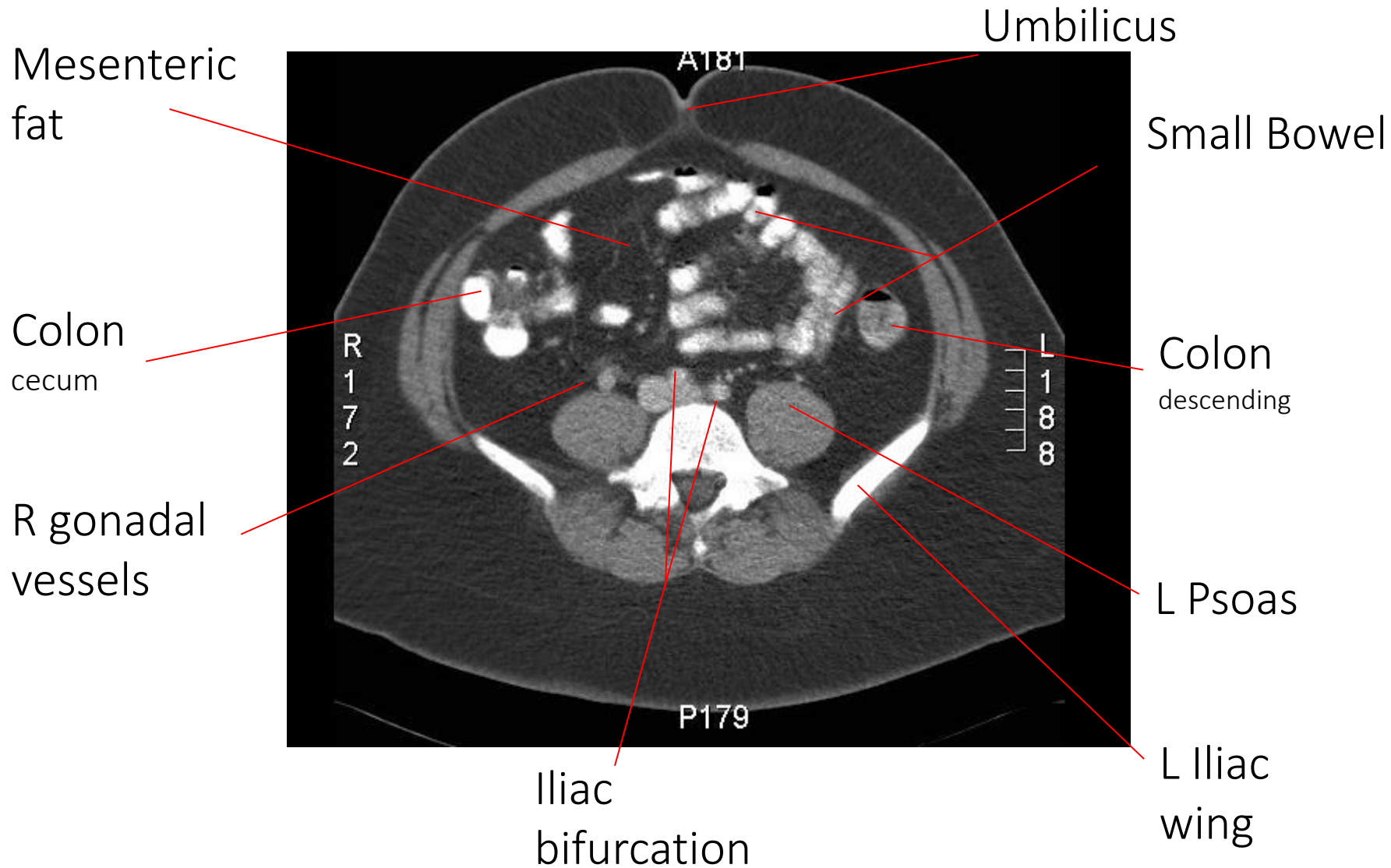
# CT Basics - Axial Anatomy



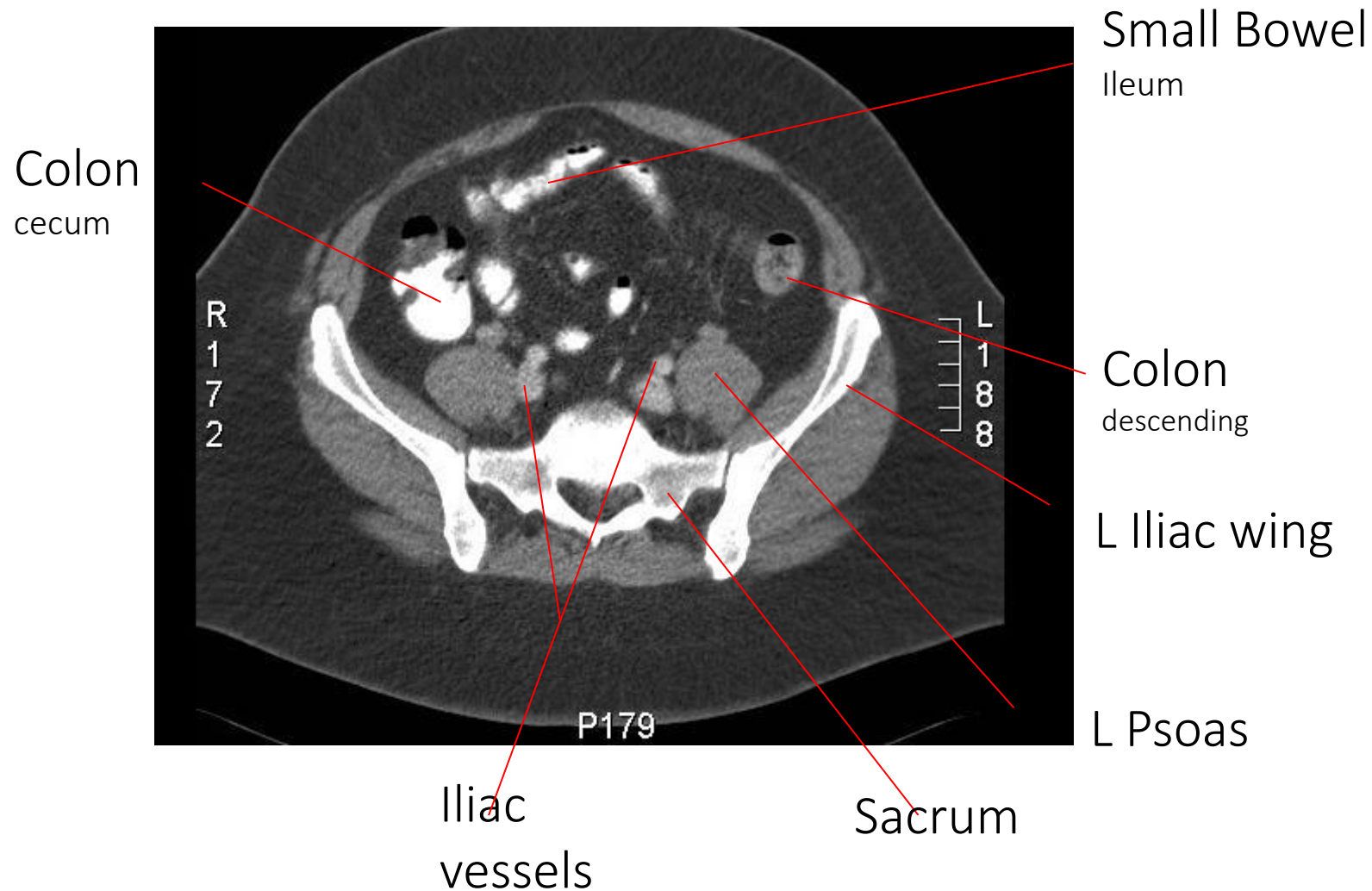
# CT Basics - Axial Anatomy



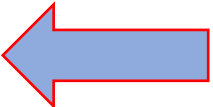
# CT Basics - Axial Anatomy



# CT Basics - Axial Anatomy



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# Case #1 - 45 yo MVA





# Case #1 - 45 yo MVA

## What do you see?

Gallbladder



Free Fluid

Active contrast  
extravasation

Axial CT with contrast: free fluid around liver,  
splenic lac with active extravasation

Laceration,  
Spleen

Case #2 - 67 yo with dull abdominal pain and a palpable mass





# Case #2 - 67 yo with dull abdominal pain and a palpable mass



Axial CT without contrast: aortic aneurysm with active retroperitoneal extravasation = ruptured AAA. Call Surgery!!

# Case #3 - Flank Pain and a Bladder Mass



# Case #3 - Flank Pain and a Bladder Mass – Findings?



CT axial w/ contrast.  
Left hydronephrosis

CT Axial, delayed phase.  
Two right ureters. Two left  
ureters, one opacified,  
one dilated and not  
opacified.



# Case #3 - Flank Pain and a Bladder Mass – Findings?



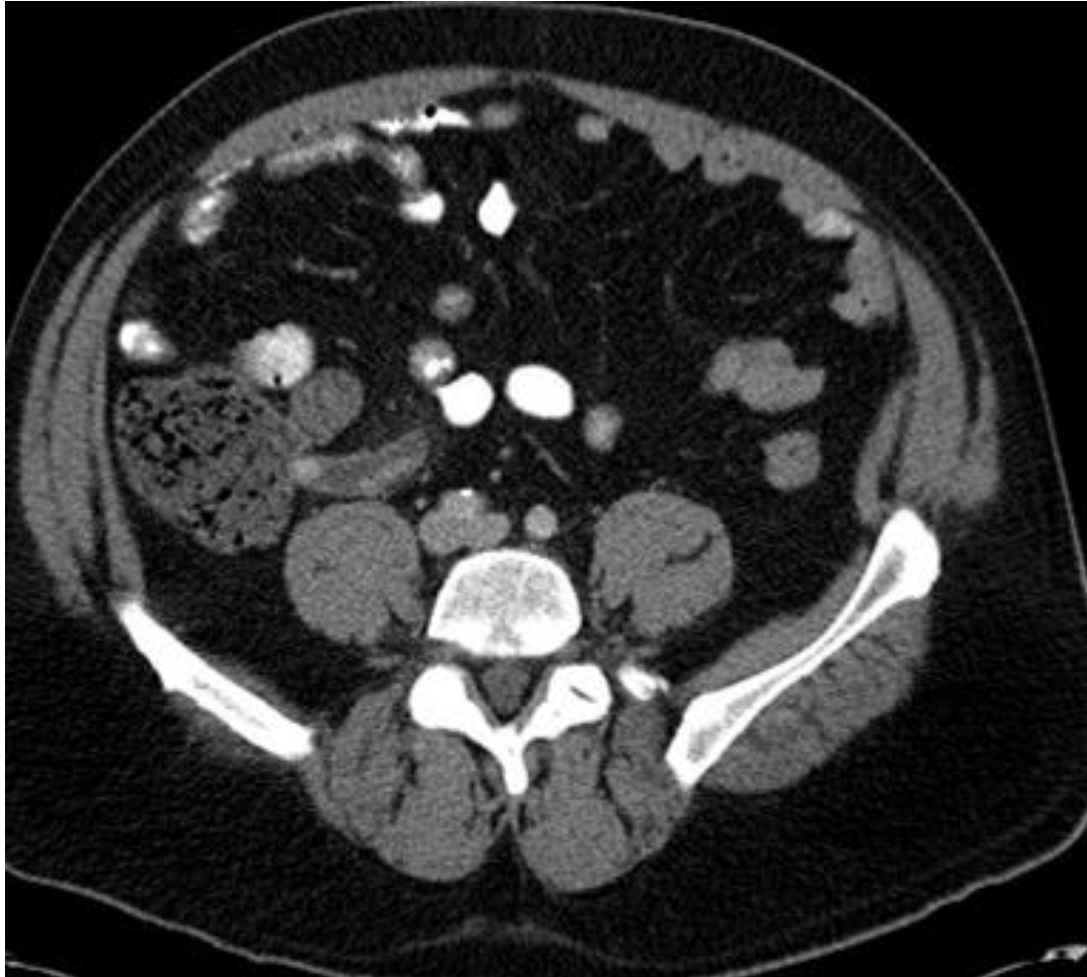
Coronal CT, delayed phase. Duplicated collecting systems, dilated left upper pole moiety. Left ureterocele.

## Weigert Meyer Rule:

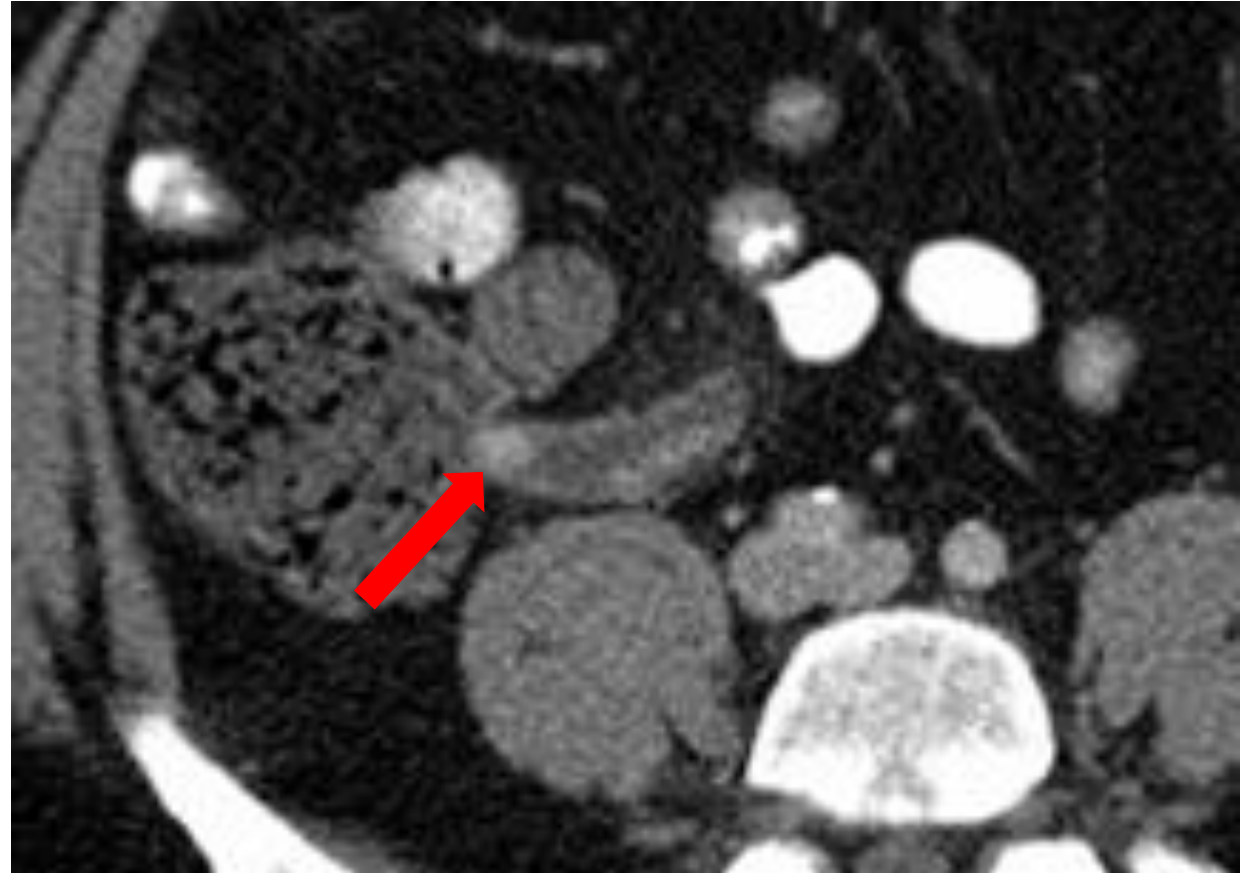
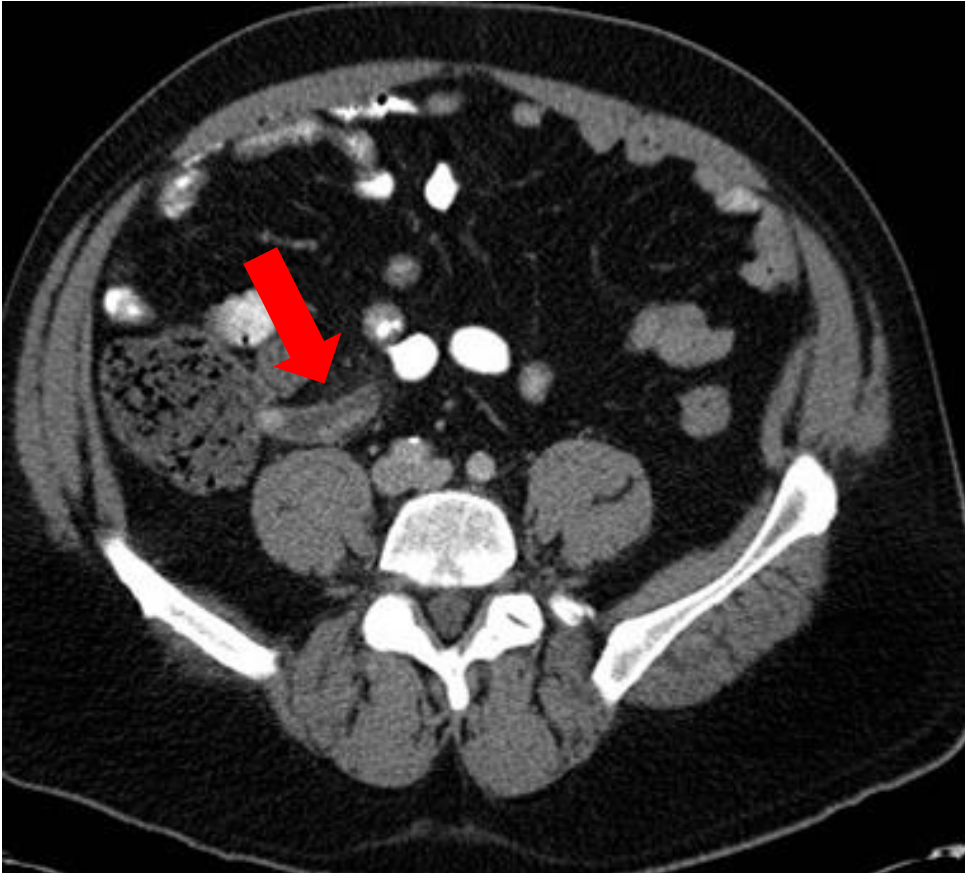
- For duplex kidneys with complete ureteral duplication, the upper renal ureter will have an ectopic insertion that is located medially and inferiorly to the lower pole ureter.
- The upper renal ureter will often form a ureterocele
- The lower renal ureter will have an insertion located laterally and superiorly, and will often be subject to reflux.



## Case #4 - RLQ Pain



## Case #4 - RLQ Pain



Findings: Dilated tubular structure in the right lower quadrant attached to the cecum. Few high density round structures at the appendix base - Could be appendicoliths. Diagnosis: Appendicitis

## Wrap Up

For CT protocols, think of indication before ordering study  
Renal colic - order non contrast  
Routine - order IV and PO contrast

- CTA is arterial phase study to evaluate arteries, trauma
- Contrast allergies: shellfish is NOT contraindication
- Contrast allergy premeds: prednisone & Benadryl
- Contrast serum creatinine  $<1.8$ , but dialysis pt ok (if they don't make urine!)
- Radiation effective dose of CT AP  
10 mSv  $\sim$ 3 years background radiation


Questions???

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



Mar 28, 2019

UNC Rad Residency @UNCRadRes

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

## Welcome to the UNC Radiology Residency Education Website!

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

## 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 10am RADY 401 Cas 1pm Intro to VIR Dr	27 2pm Best of Breast 4pm Ms Cluck Sim L	28 1pm Meet Aunt Minn	29	30 TEC Block 11 Ends 10am RADY 401 Fin	Feb 1
	2	3 TEC Block 12 begin	4 RADY Symposium	5 1pm Intro to Cardio	6 1pm CXR Unknowns	7 8
	9 1pm Intro to Abdom	10 11am RADY 401 Intri 2pm Approach to the	11 RADY Symposium 8am Cervical spine C 9am Body CT Dr Dec	12	13 1pm Intro to Muscul	14 2pm Radiologic Eval
						15

More at [www.rads.web.unc.edu](http://www.rads.web.unc.edu) [www.msrad.web.unc.edu](http://www.msrad.web.unc.edu) and @UNCRadRes

Thank you!