

CT Protocols for Common Primary Care Diagnoses

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CT Protocols – IV Contrast

- **Indications**
 - Mass/malignancy/staging
 - May require a special multiphase protocol
 - Infection/Inflammation
 - “Pain”
 - Unsure
 - Angiograms
- **Contraindications**
 - Allergy
 - GFR>30 (>45)
 - Caution in hypertension, diabetes, renal transplant, single kidney, CRD
- **Not needed**
 - Organ size
 - Follow renal stones
 - Hernia
 - Retroperitoneal hemorrhage
- **Imaging Phases**
 - Arterial phase
 - Contrast has not yet reached the organ, in arteries only
 - *Portal venous phase
 - Organ has perfused, contrast returning through venous system
 - Delayed phase
 - Equilibrium state where contrast has returned to venous system, beginning to be renally excreted
- Affected by cardiac function, anatomy, and physiology

Renal Function Guidelines

- In the outpatient setting, the following patient population will require renal function screening within 30 days of contrast administration:
- Age >65 years
- History of renal disease, including
 - Kidney transplant
 - Single kidney
 - Kidney cancer
 - Kidney surgery
 - History of renal insufficiency
- History of hypertension requiring medical therapy
- History of diabetes
- Metformin (or metformin-containing drug combinations)

eGFR > 60 (very low risk)	No restrictions
eGFR 45-60 (low risk)	If acute renal failure, consider IV hydration. Otherwise, encourage oral hydration and salt loading as clinically appropriate.
eGFR 30 – 44 (moderate risk)	Consider alternative exams (MRI/Ultrasound). Otherwise IV hydration required (see below) unless documented that medical emergency precludes hydration. Iodixanol (Visipaque) contrast is suggested.
eGFR < 30 (high risk)	No IV contrast unless approved by nephrology or deemed a medical emergency, which must be documented. Iodixanol (Visipaque) contrast is suggested in the event of a documented medical emergency/override authorizing the administration of IV contrast.

Organ evaluation

Indication: "stone"

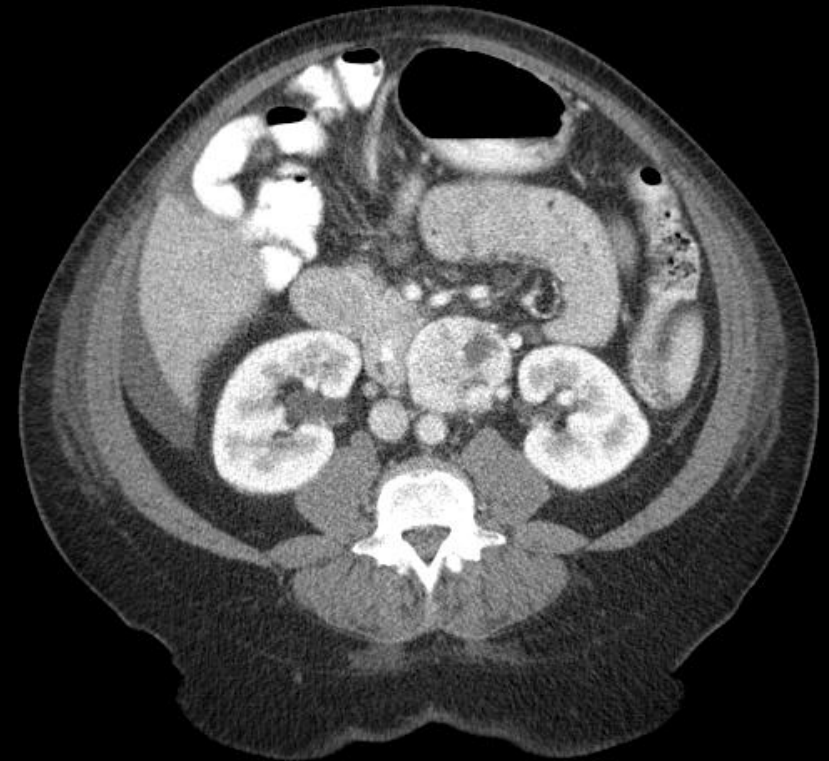


Pyelonephritis

Normal

Mass evaluation

Indication: “early satiety”



Extra-adrenal
Pheochromocytoma

CT Protocols – Oral Contrast

- **Indications - Body**
 - Mostly for us to identify bowel
 - From other structures
 - Evaluate wall
 - Volumen
 - Functional
 - Evaluate gastric bypass
 - Post surgical is a must!
 - Gastrograffin
- **Contraindications**
 - Intolerance
 - Will obscure your finding
- **Not needed**
 - Angiograms
 - Organ specific exams
- **Bladder Contrast**
 - Fistula
 - Bladder wall integrity
- **Rectal Contrast**
 - Fistula
 - Post surgical
 - Penetrating trauma
- **“Size Matters”**
- **Things are different in the ER setting**

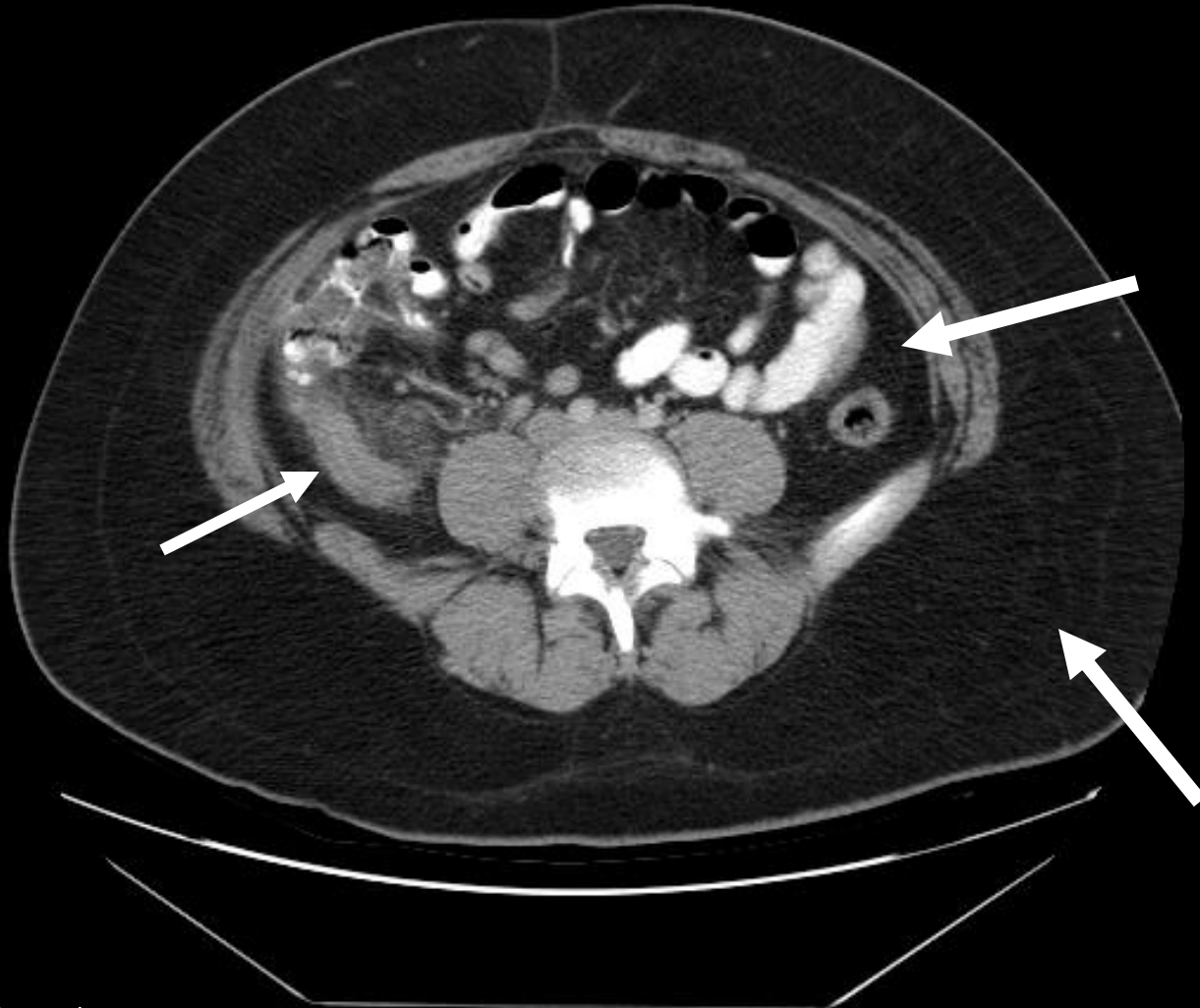
Early Acute Appendicitis No Oral Contrast



Early Acute Appendicitis With Oral Contrast

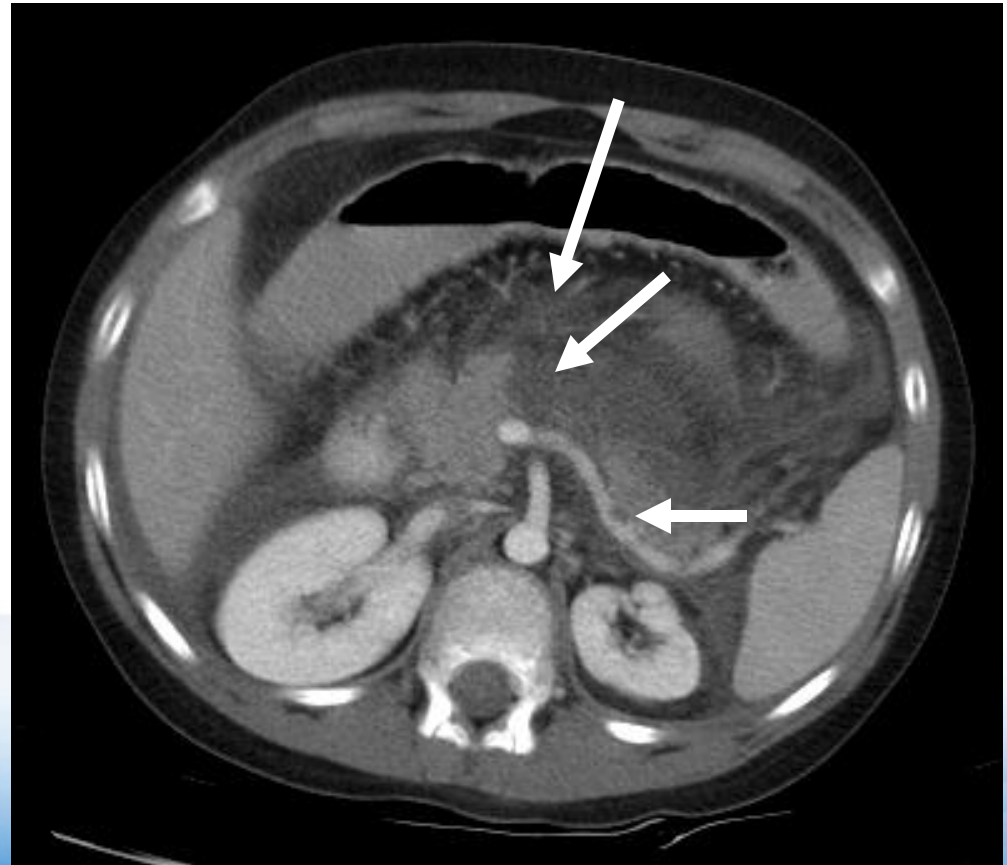


Late Acute Appendicitis With Oral Contrast + “Internal Contrast”



CT Abd/Pelvis I+ “Routine”

- 1 scan: Portal Venous
- *Indications:*
 - Evaluate visceral organ
 - Pain
 - Unsure
- *NOT optimal for looking at arterial anatomy or for occlusion (mesenteric ischemia)*



Acute Pancreatitis
Necrosis
Splenic Vein Thrombus

Acute, Uncomplicated Diverticulitis



Complicated Diverticulitis with Gas-Containing Abscess

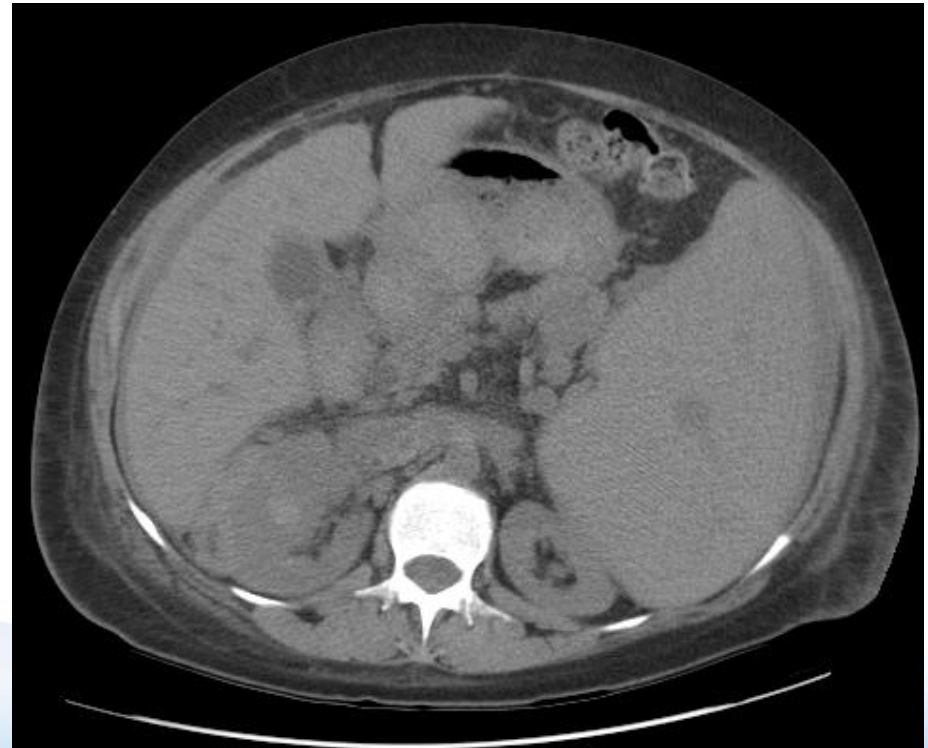


Acute Cholecystitis



CT Abd/Pelvis I- or KUB

- 1 scan: Noncontrast
- *Indications:*
 - *Contrast is not necessary to see the findings*
 - Retroperitoneal hemorrhage
 - Kidney stones
 - Organ size
 - Hernia
 - *Contrast might obscure your finding*
 - Hepatic steatosis
 - *Patient cannot have contrast*



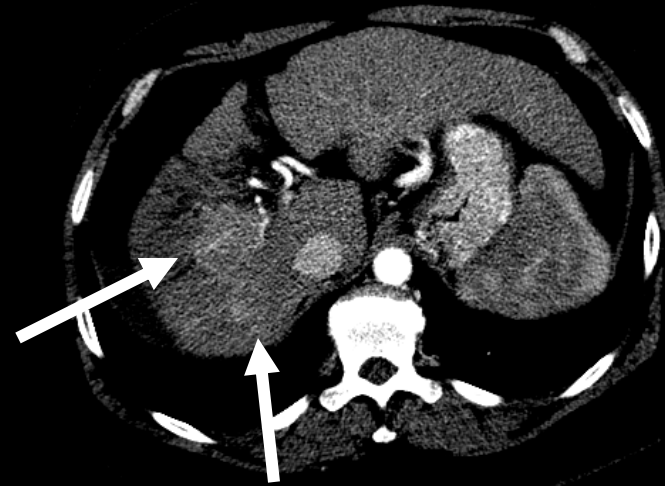
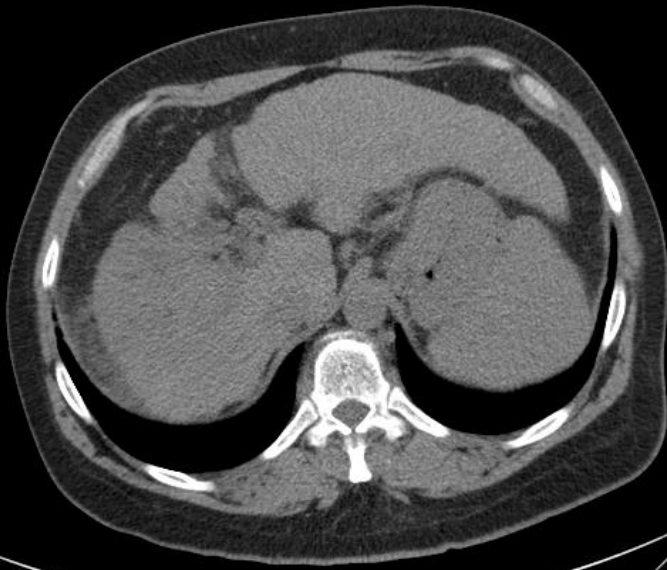
Splenomegaly (Lymphoma)

CT Liver I-/I+

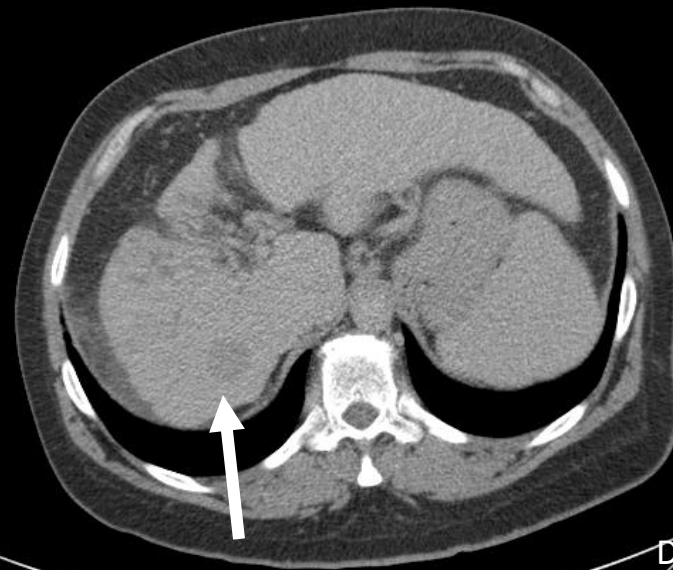
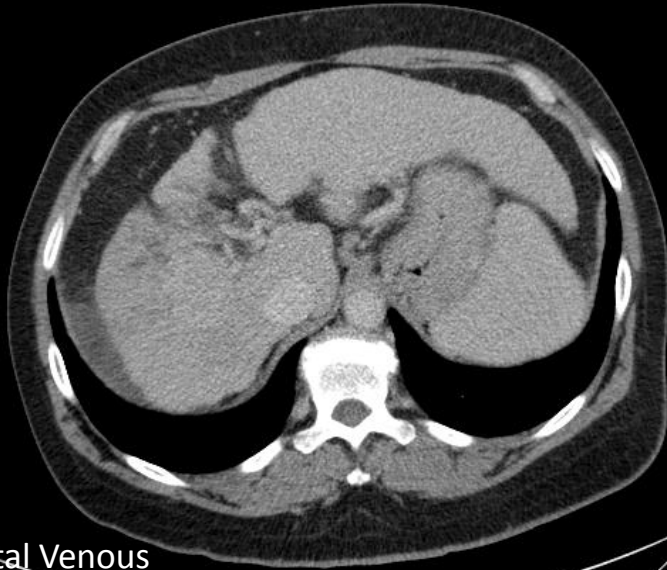
- 4 scans: Noncontrast, Arterial Portal Venous, Delayed
- *Indications:*
 - *Should be considered in any patient with cirrhosis*
 - HCC detection or follow up
 - Characterization of previously detected liver mass (seen on US, Routine CT A/P)
 - Follow up ablation or TACE
 - *Consider including pelvis if first time or looking for ascites*

Noncontrast

Arterial



Hepatocellular Carcinoma

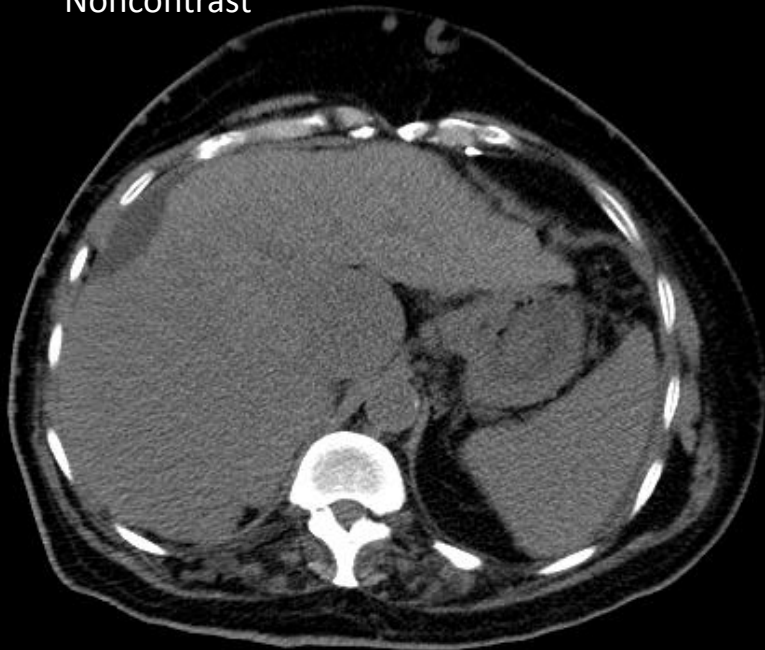


16 | Portal Venous

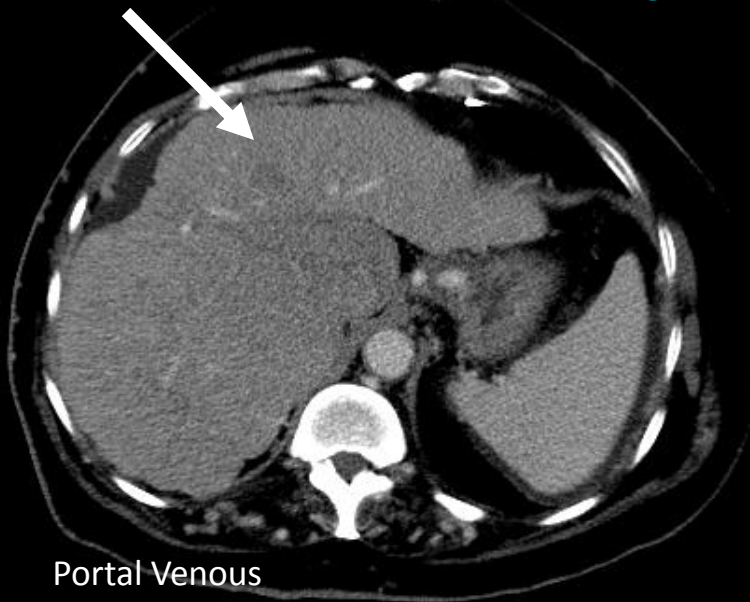
Delayed

Noncontrast

Arterial

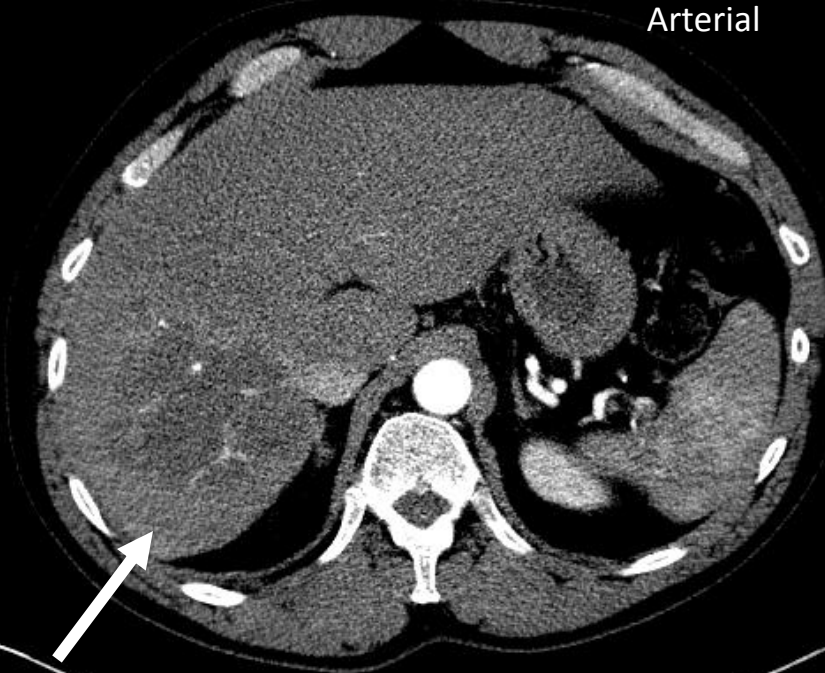


Massive Infiltrating Hepatocellular Carcinoma

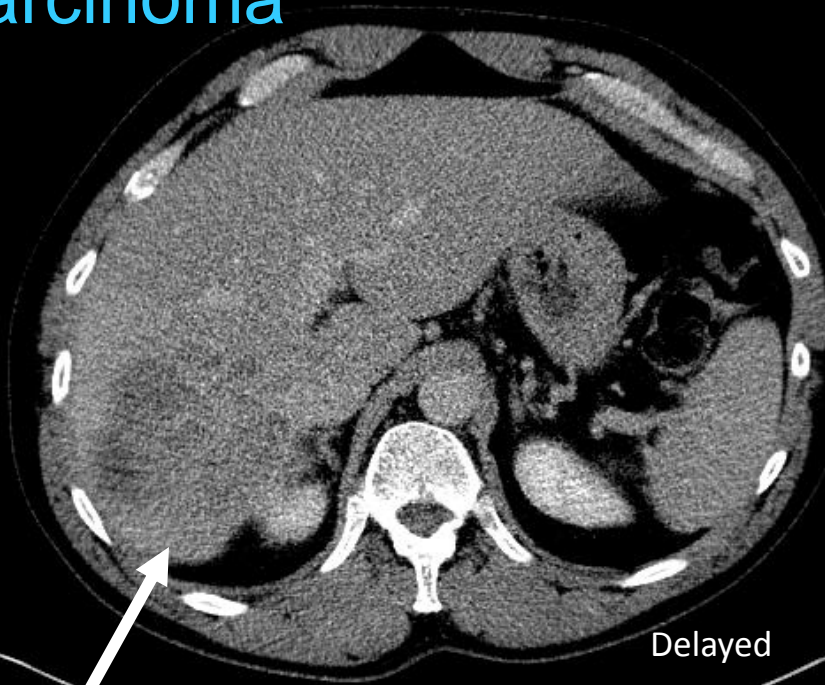
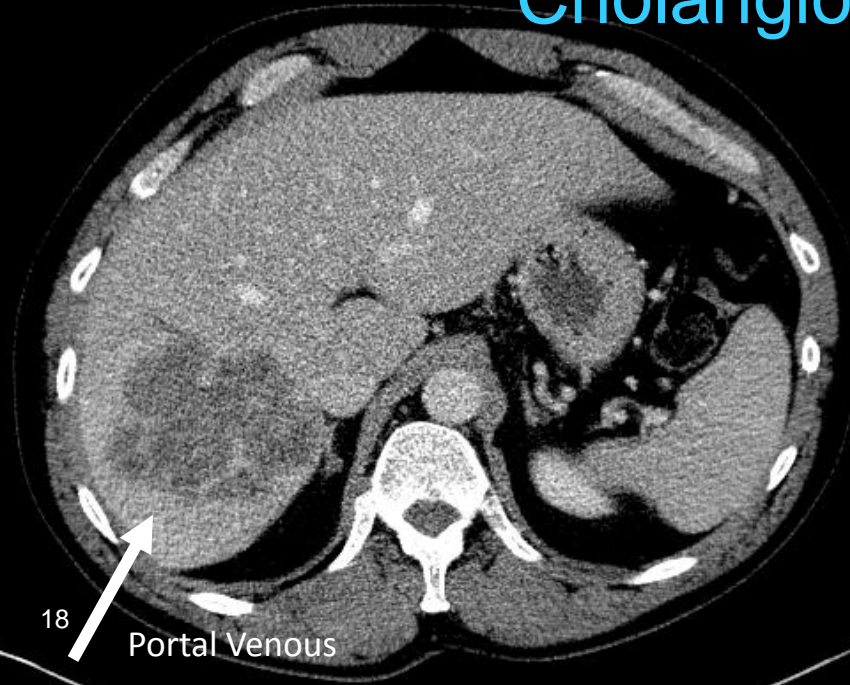


Noncontrast

Arterial



Cholangiocarcinoma



18

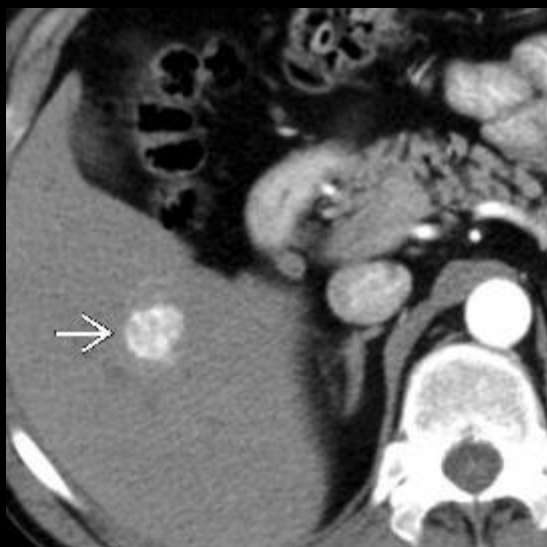
Portal Venous

Delayed

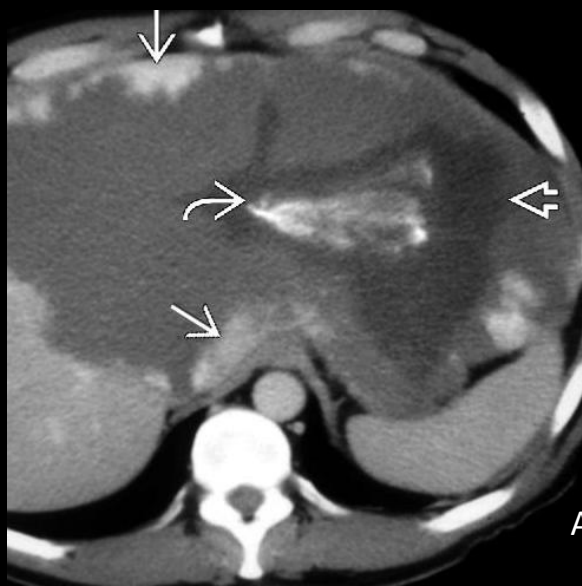
Arterial

Portal Venous

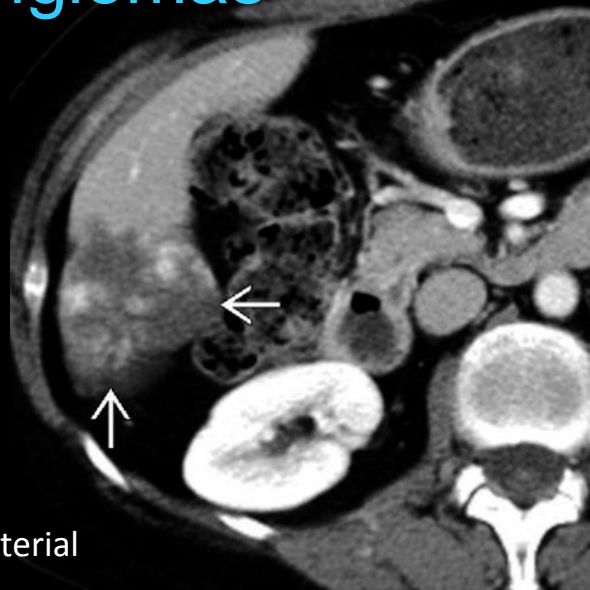
Delayed



Hemangiomas



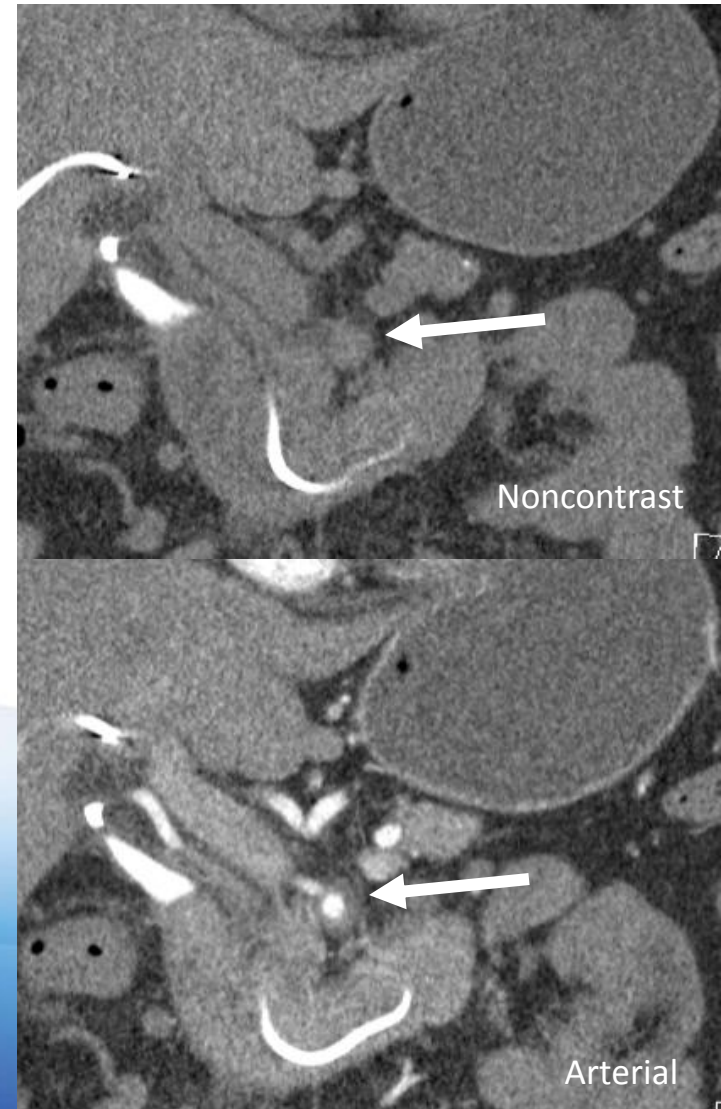
Arterial



CT Pancreas I-/I+

- 3 scans: Noncontrast, Arterial, Portal Venous
- *Indications:*
 - *Not appropriate for screening for pancreatic mass or for acute pancreatitis*
 - To characterize a previously detected uncharacterized pancreatic lesion, surgical planning
 - *Resectability*
 - Involvement of regional arteries and veins

Pancreatic carcinoma
With encasement of the SMA



CT Renal Mass I-/I+

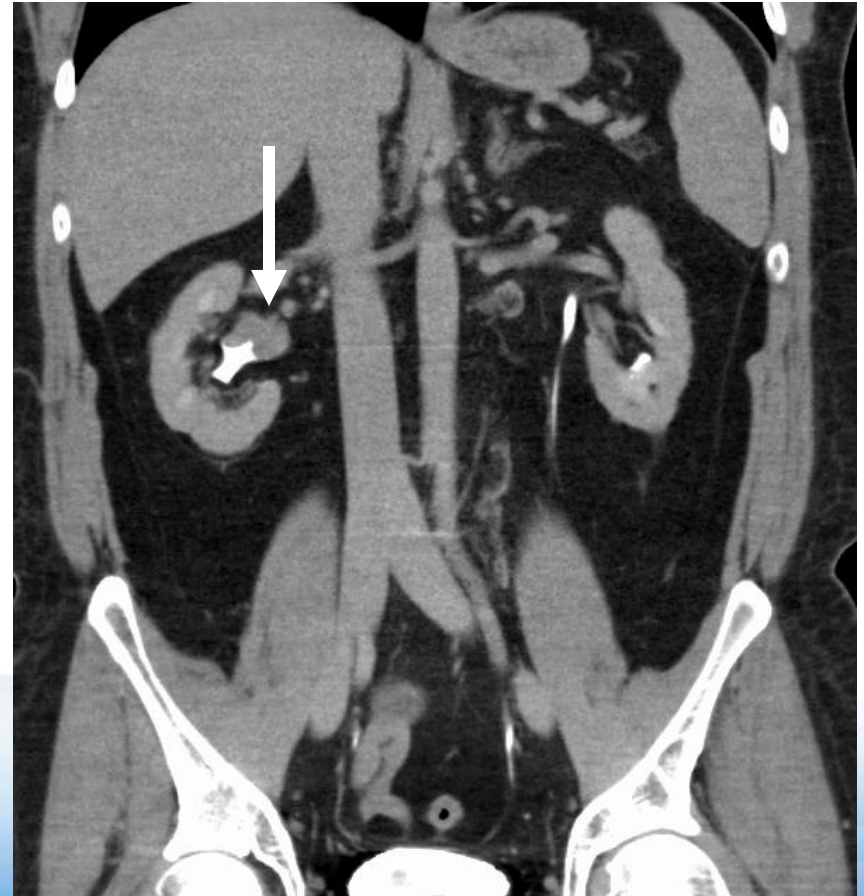
- 3 scans: Noncontrast, Arterial, Portal Venous
- *Indications:*
 - *Not appropriate for screening*
 - To characterize a previously detected renal lesion
 - *Does not include a delayed phase, so it is not optimal for looking at collecting system abnormalities or detecting TCC*



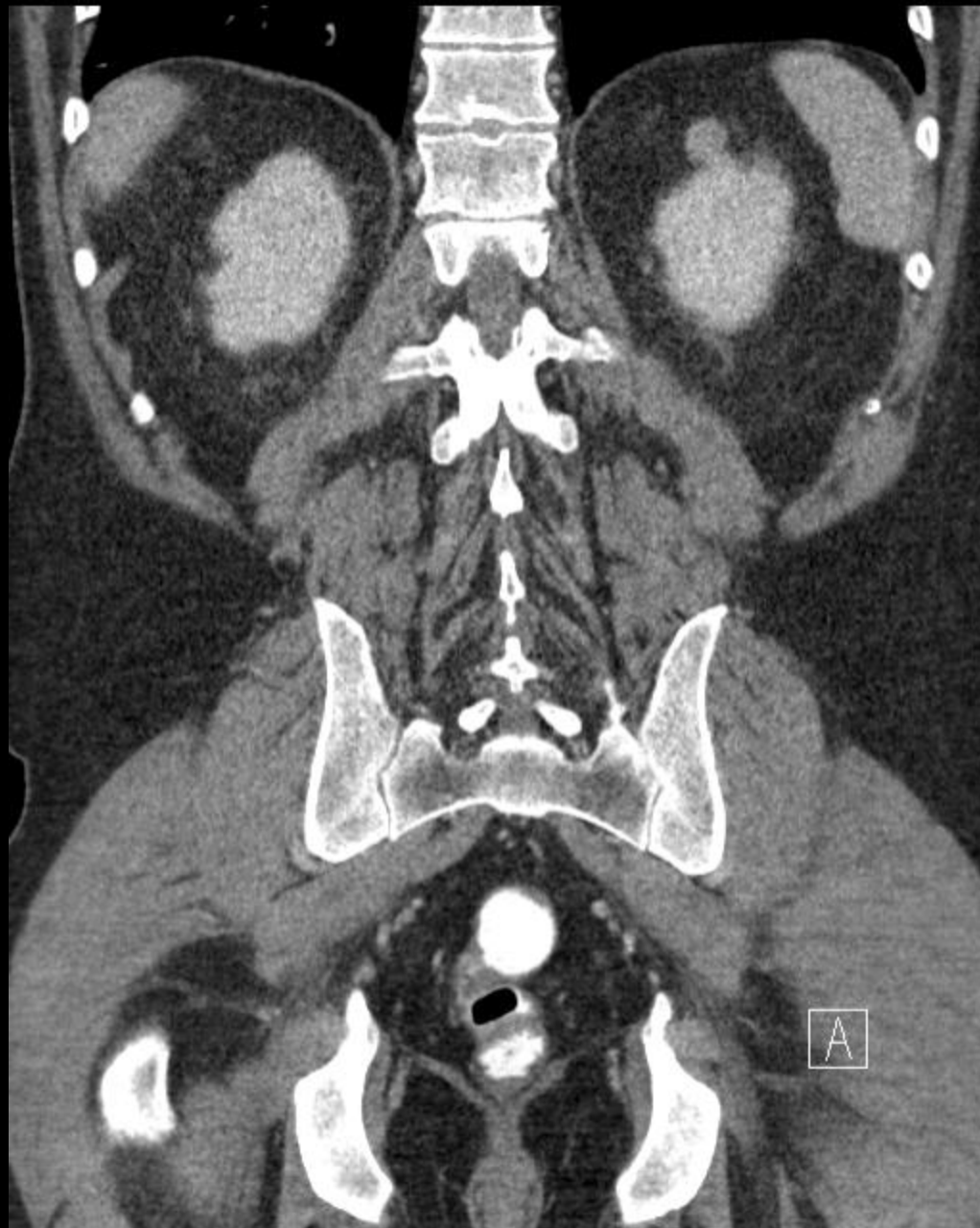
Renal Cell Carcinoma

CT Urogram I-/I+

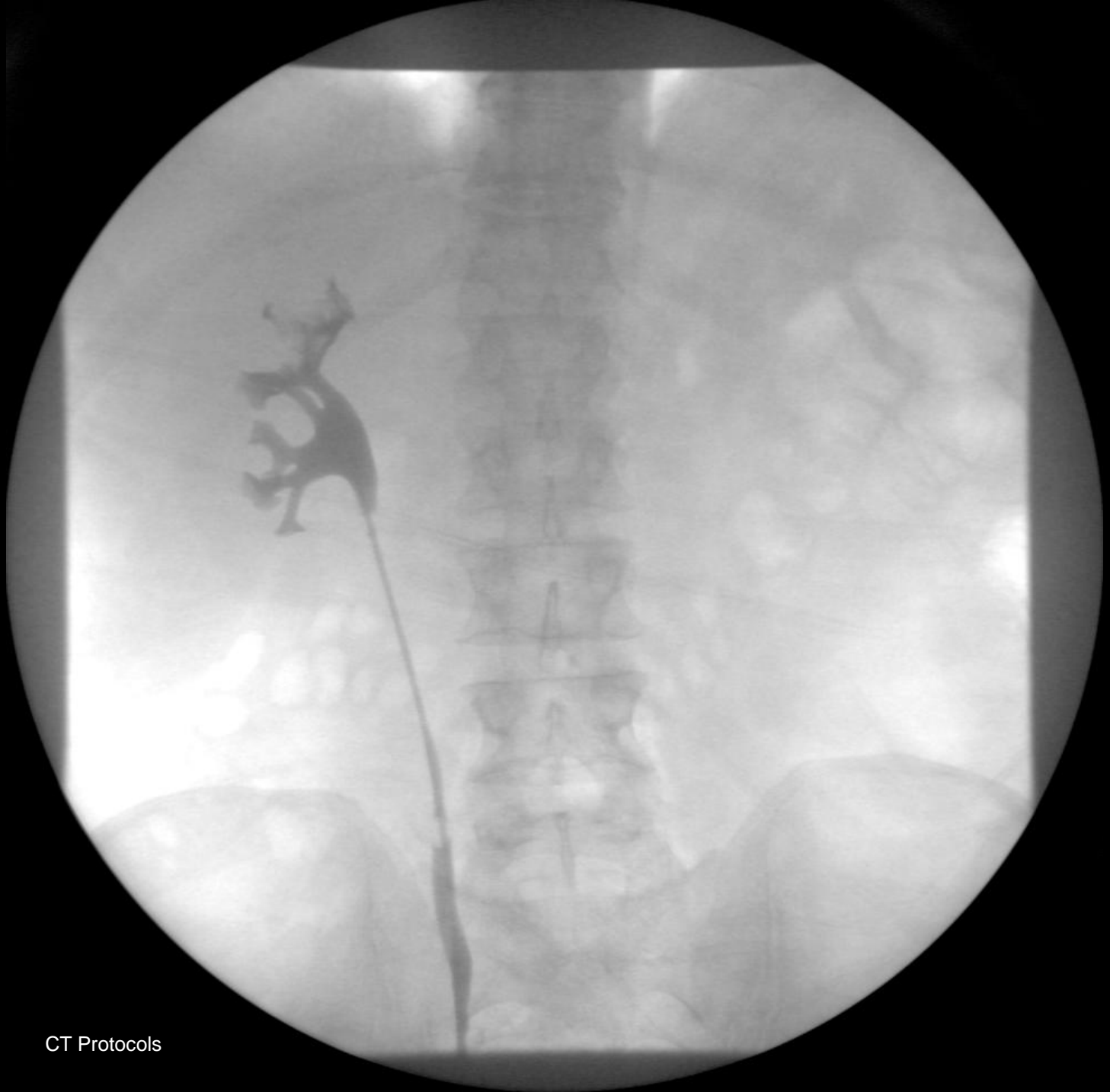
- 2 scans: Noncontrast, Combo Nephrographic/Excretory
- *Indications:*
 - *Optimized study to look at renal parenchyma AND collecting system*
 - Microscopic hematuria
 - Detecting transitional cell carcinoma (TCC)
 - *Not good for looking at renal (parenchymal based) mass or indeterminate cysts*



Transitional Cell Carcinoma







Other Body CT Protocols

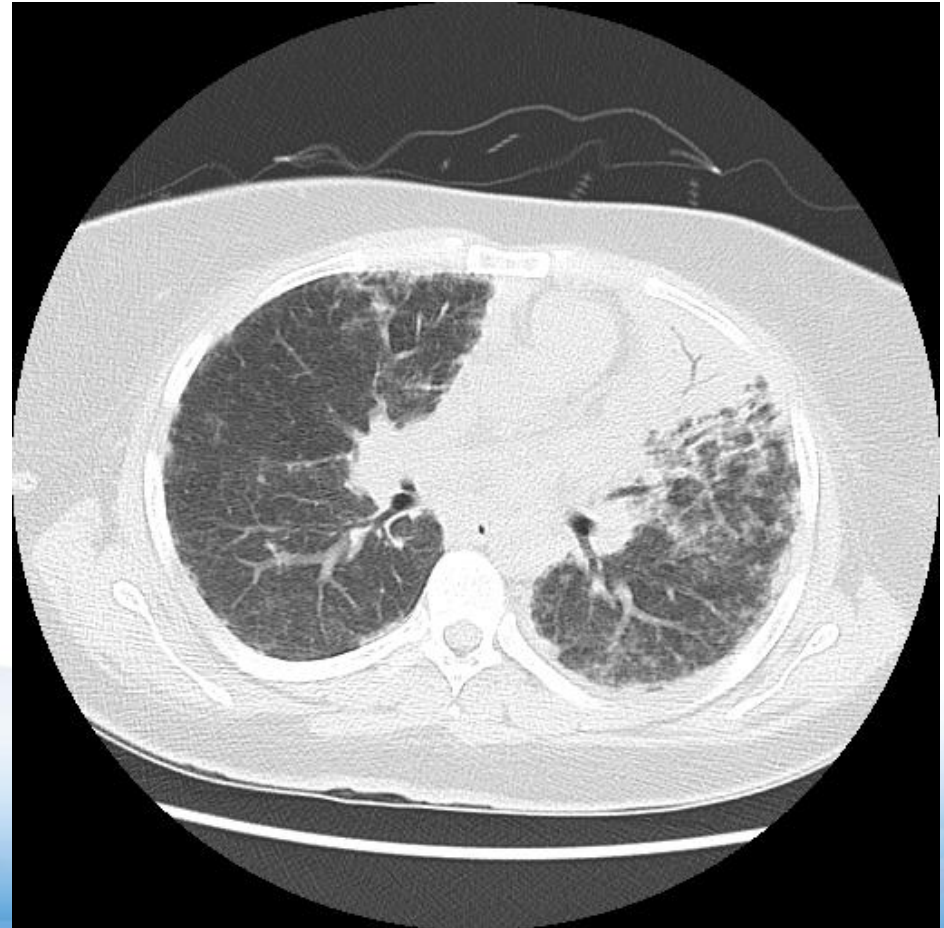
- CT Enterography I+O+ Volumen
 - 1 scan: Portal Venous
 - *Indications:*
 - Crohns/IBD
 - Malabsorption
- Renal Donor Protocol I-/I+
 - 3 scans: Noncontrast, Arterial, Venous
- Liver Donor Protocol I-/I+
 - 3 scans: Arterial, Venous, Delayed
- CT Colonography I-/O+/CO2+
 - 2 scans: O+ prone and supine after previous day bowel prep

Thoracic Imaging



CT Chest I- “Routine”

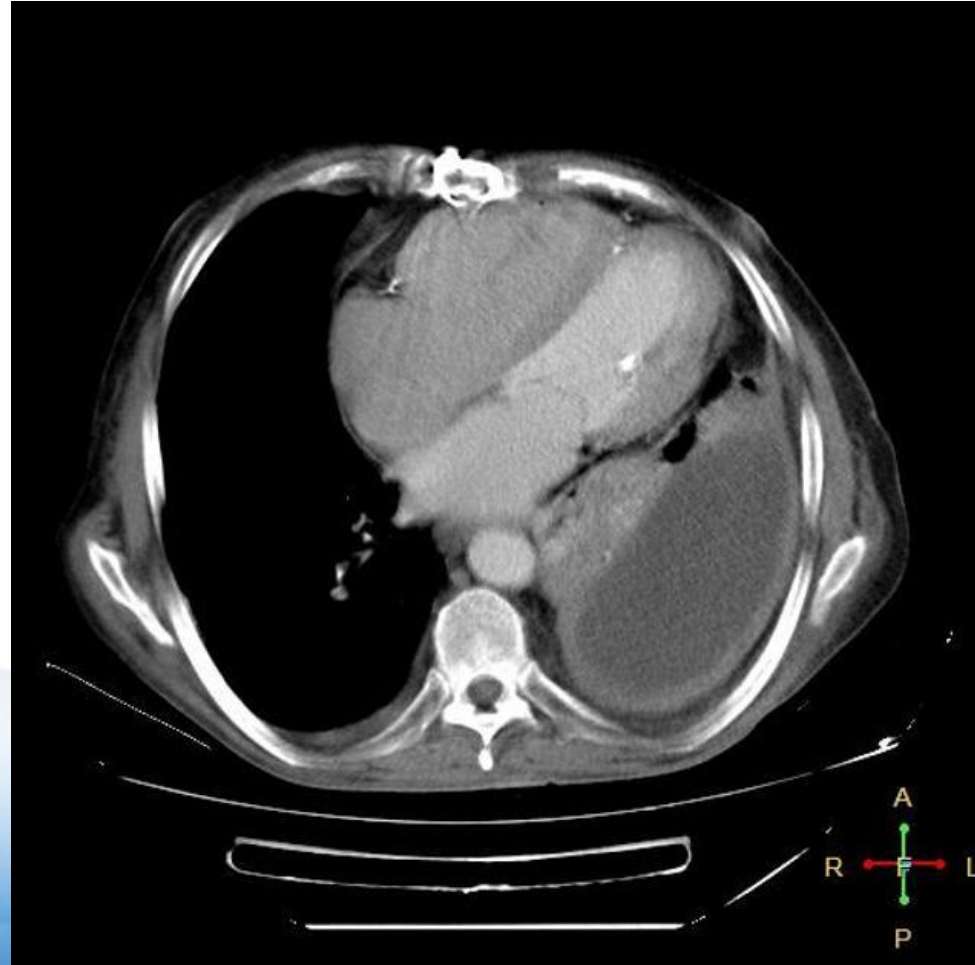
- 1 scan: Noncontrast
- *Indications:*
 - Pneumonia/Atelectasis
 - Emphysema
 - Pulmonary nodules
 - Pleural effusions
- *Special scenarios:*
 - Low dose nodule f/u
 - High resolution for interstitial lung disease
 - More scans (supine/prone, inspiratory/expiratory)



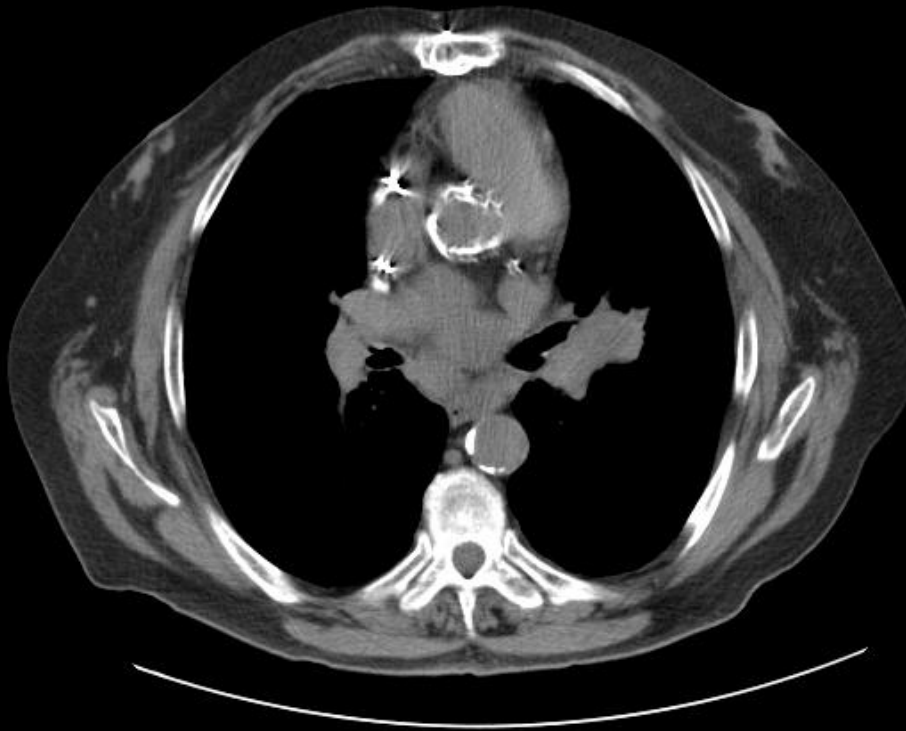
CT Chest I+ “Routine”

- 1 scan: Portal Venous
- *Indications:*
 - Mass/Malignancy
 - Especially lymphadenopathy
 - Initial sarcoid
 - Empyema
 - Pulmonary artery size
- *Not good for looking for PE (too late)*

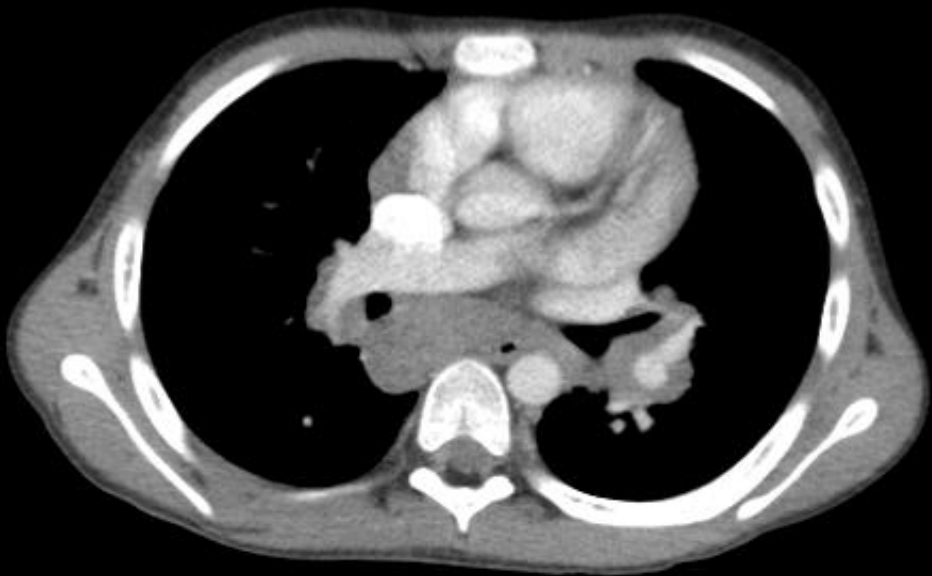
Empyema



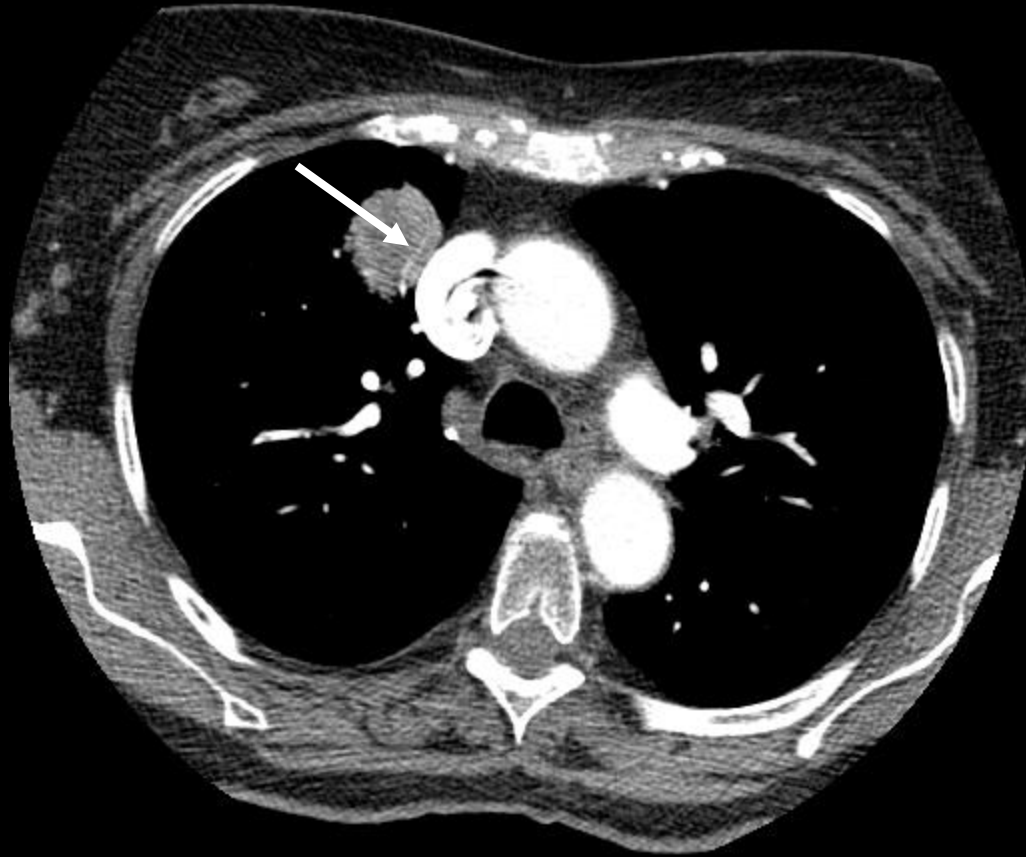
Hilar Lymphadenopathy in Small Cell Lung Carcinoma



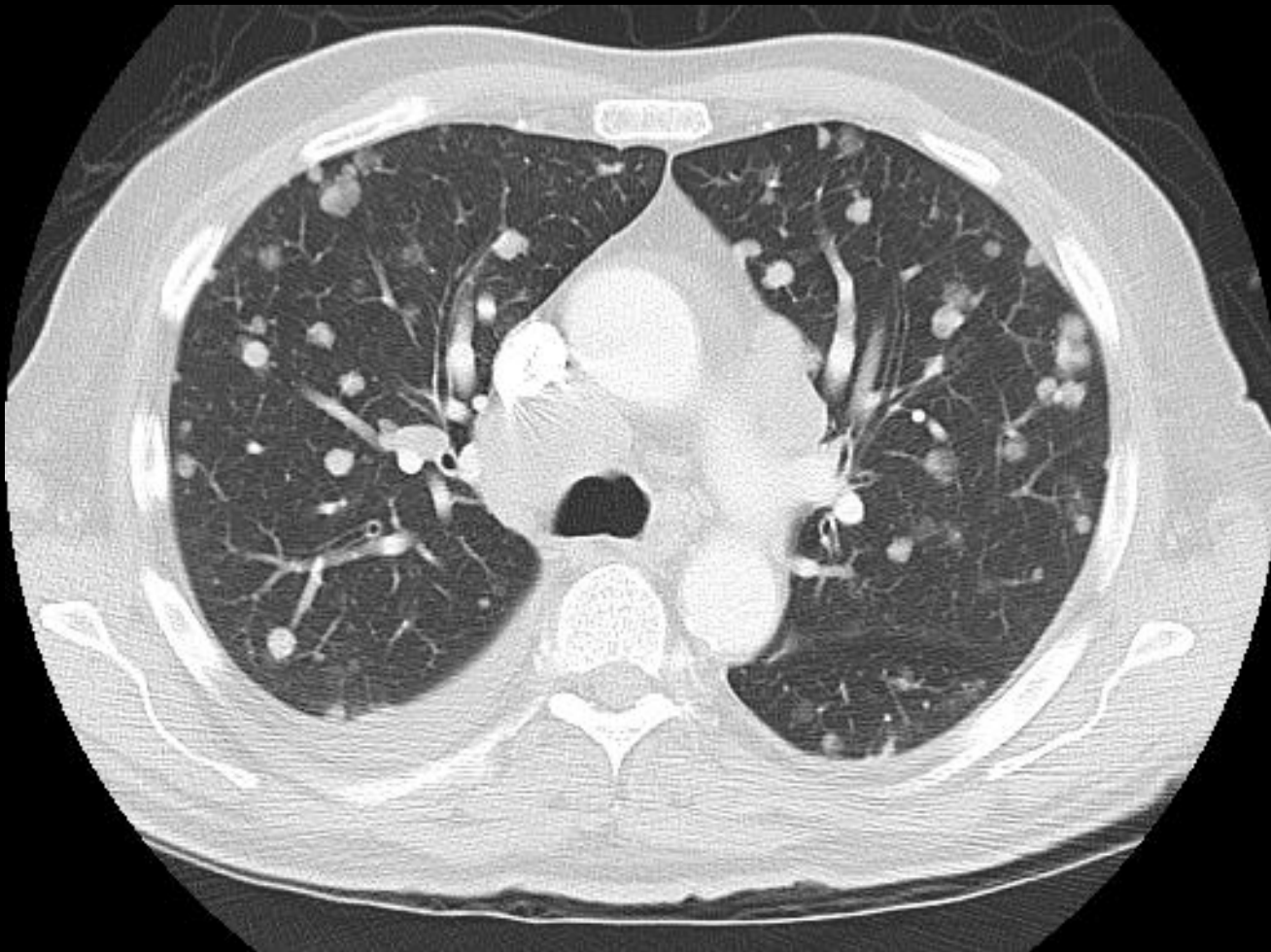
Lymphoma



Carcinoid Tumor



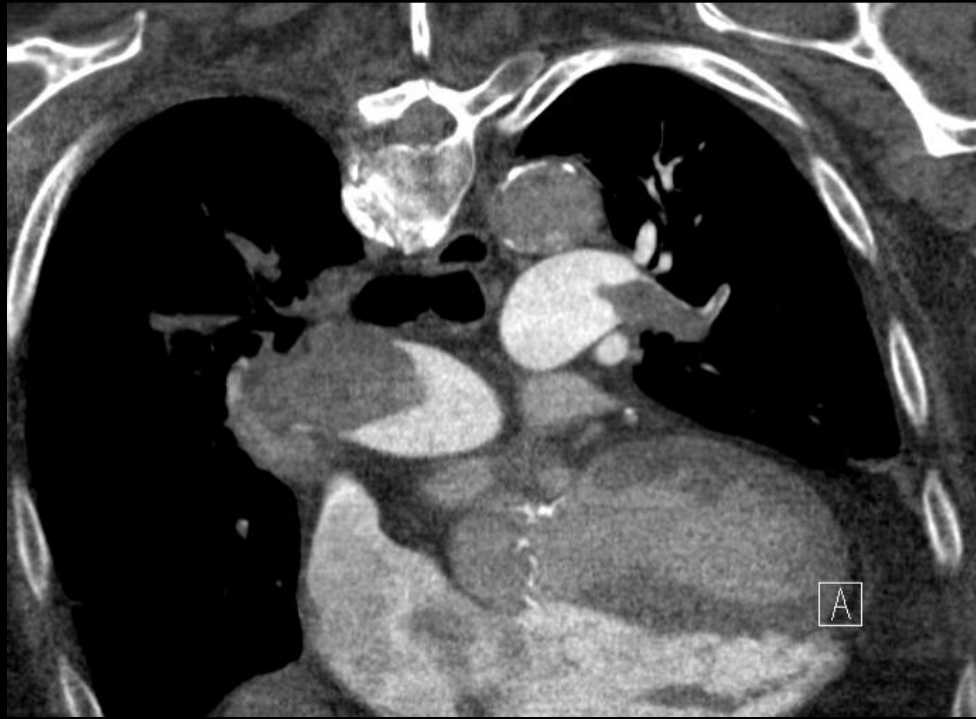
Metastatic Anaplastic Thyroid Carcinoma



CT Chest I+ PE Protocol

- 1 scan: Late Arterial (often done by bolus tracking)
- *Indications:*
 - Pulmonary embolus
- *Not good for looking at organs – contrast has not made it there yet*

Saddle Pulmonary Embolism



Other Thoracic Protocols

- Cardiac studies (depending on availability)
 - *May be gated*
 - *May require beta blocker tx*
 - Valves
 - Anatomy
 - Coronary Artery Evaluation

CT Angiograms

- No oral contrast
- CTA Aneurysm I-/I+
 - 2 scans: Noncontrast, Arterial
 - *Indications:*
 - Aortic aneurysm evaluation
 - Acute bleed (liver, bowel, spleen, etc)
- CTA Dissection I-/I+
 - 3 scans: Noncontrast, Arterial, Portal Venous
 - *Indications:*
 - Aortic dissection
 - *Portal venous phase is included to assess organ perfusion*
- CTA Stent I-/I+
 - 3 scans: Noncontrast, Arterial, Delayed
 - *Indications:*
 - Evaluate endovascular repair
 - *Delayed phase to look for delayed leak*
- CT Extremity Runoff I-/I+
 - 2 scans: Noncontrast, Arterial
 - *Indications:*
 - Cold limb, extremity ischemia
 - *Large field of view gives poor spatial resolution*
 - *Usually ordered by vascular surgery*

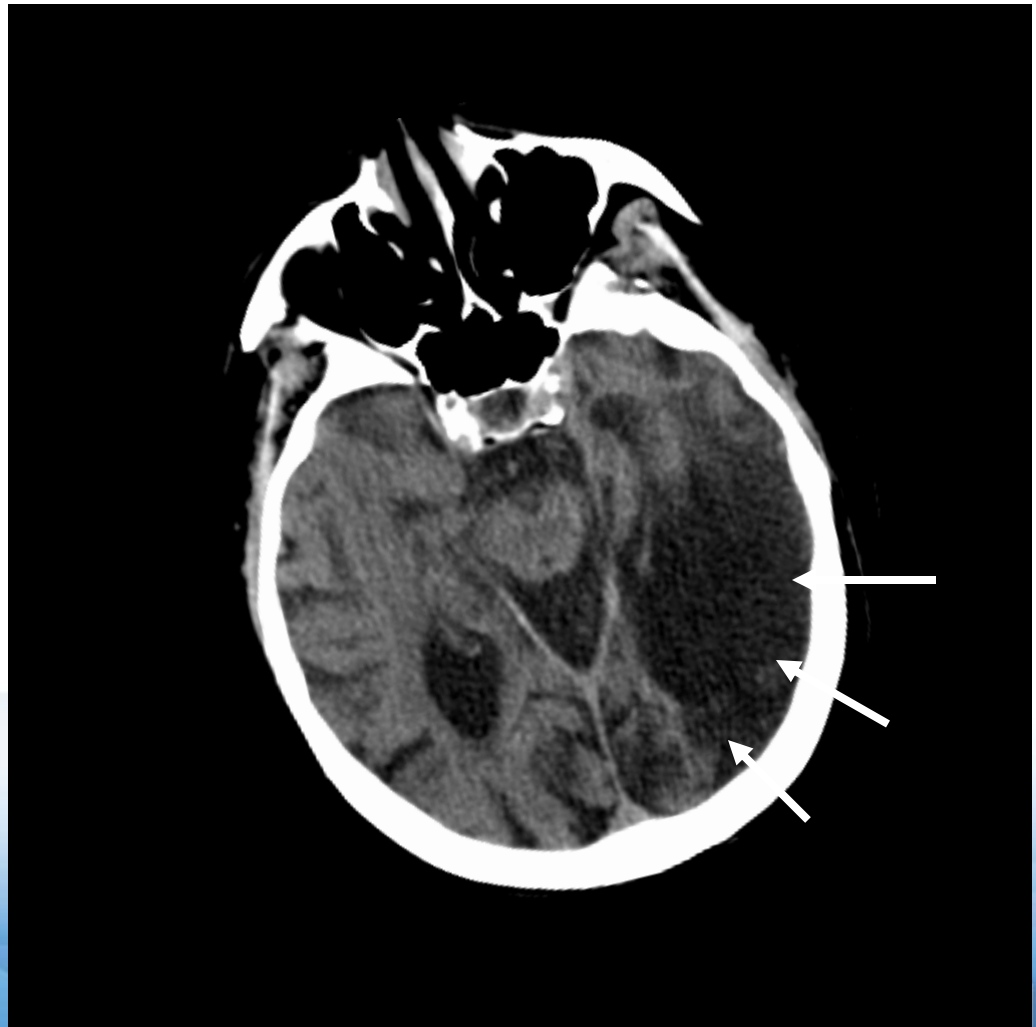
Neuro



CT Head I-

- 1 scan: Noncontrast
- *Indications:*
 - Almost always the first line evaluation
 - Acute trauma, suspected hemorrhage, stroke
 - Seizures, apnea, syncope, ataxia
- *Workhorse of head CT*

MCA Infarct





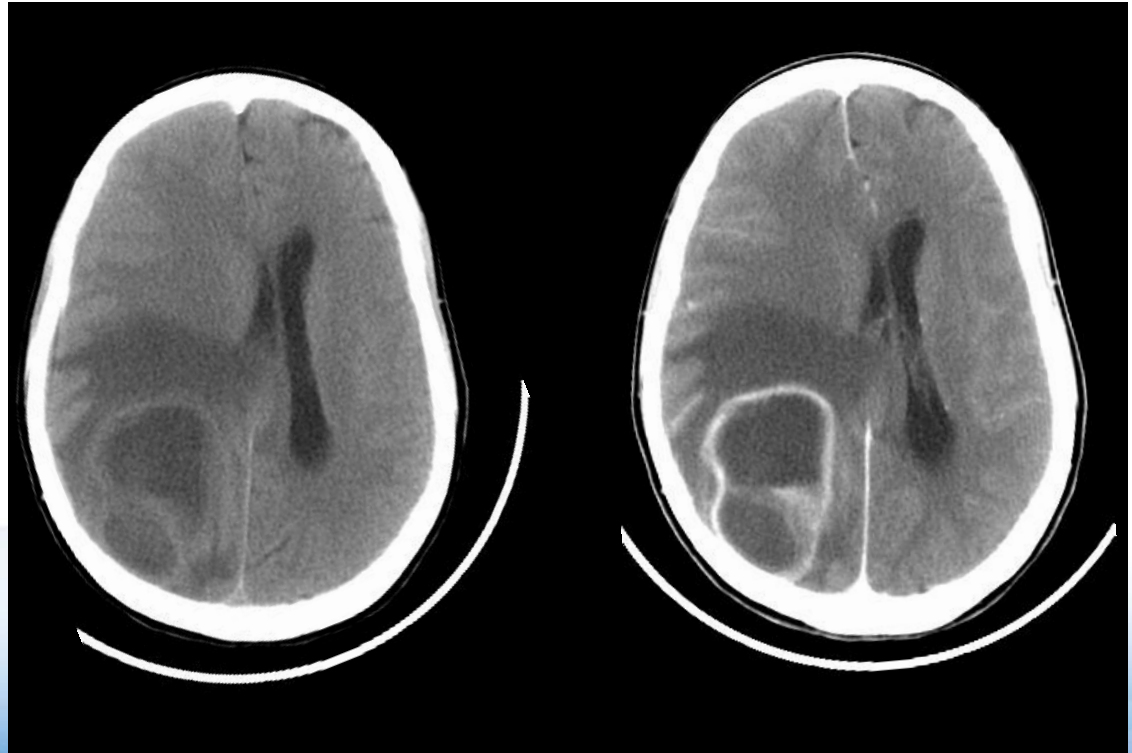
Traumatic Hemorrhage



Venous Sinus Thrombosis

CT Head I+

- 2 scans: Noncontrast, Contrast
 - Almost always do in ADDITION to I-
- *Indications:*
 - Mass
 - Infection
- *Can obscure small hemorrhage*
- *Different from CTA Head (stroke)*



Abscess

CT Cervical Spine I-

- 1 scan: Noncontrast
- *Indications (bone):*
 - Neck pain (DJD)
 - Post trauma
 - Post operative
- *Not good for looking at the soft tissues of the neck*



Compression Fracture

CT Neck I+

- 1 scan: Portal Venous
- *Indications:*
 - Mass
 - Malignancy
 - Infection
 - Lymphadenopathy
- *Still see cervical spine*
- *Different from CTA Neck (for stroke or dissection)*



Branchial Cleft Cyst

CTA Head and Neck I+

- 2 scans: Noncontrast head; Arterial through the head and neck
- *Indications:*
 - *Stroke
 - Dissection
 - Post traumatic
- *Different from CT Head and Neck I+*

Other Misc Neuro Exams

- CT Nasal Bones I-
 - Trauma
- CT Sinus/Maxillofacial I-
 - I+ if looking for infection/abscess, neoplasm
- CT Temporal Bones I-
 - Hearing loss, cholestatoma, post surgical
- CT Parathyroid I+
 - 4D parathyroid CT for parathyroid adenoma

Musculoskeletal Protocols

- For bone, contrast doesn't add much
 - Only use I+ if planning to evaluate soft tissues or soft tissue component
- CT is best for bone
 - If concerned for soft tissues, MRI is far superior
 - Ultrasound may be a good place to start (insurance issues)

Thank You!

- Please feel free to contact me with any questions about this presentation, CT protocols, or radiology in general!
- lacey.mcintosh@gmail.com

Helpful References

- ACR Appropriateness Criteria

<http://www.acr.org/Quality-Safety/Appropriateness-Criteria>

Date of origin: 1996
Last review date: 2013

American College of Radiology ACR Appropriateness Criteria®

Clinical Condition: Right Lower Quadrant Pain—Suspected Appendicitis

Variant 1: Fever, leukocytosis, and classic clinical presentation for appendicitis in adults.

Radiologic Procedure	Rating	Comments	RRL*
CT abdomen and pelvis with contrast	8	Oral or rectal contrast may not be needed depending on institutional preference.	☺☺☺☺
CT abdomen and pelvis without contrast	7	Use of oral or rectal contrast depends on institutional preference.	☺☺☺☺
US abdomen	6	Perform this procedure with graded compression.	○
US pelvis	5	This procedure is appropriate in women with pelvic pain.	○
MRI abdomen and pelvis without and with contrast	5	See statement regarding contrast in text under “Anticipated Exceptions.”	○
X-ray abdomen	4	This procedure may be useful when there is concern for perforation and free air.	☺☺
CT abdomen and pelvis without and with contrast	4	Oral or rectal contrast may not be needed in this procedure depending on institutional preference.	☺☺☺☺
MRI abdomen and pelvis without contrast	4		○
X-ray contrast enema	2		☺☺☺
Tc-99m WBC scan abdomen and pelvis	2		☺☺☺☺
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level