Abdomen and Pelvis Imaging Procedures

Indications

1- To assess equivocal imaging findings.
2- Staging of hepatic neoplasms .
3- Metastatic workup of primary malignancies.
4- Diagnosis of abdominal masses .
5- Assessment of biliary problems .
6- Diagnosis of Vascular lesions .
7- Assessment of post-traumatic complications.

GENERAL ABDOMINOPELVIC SCANNING METHODS:

requires

- Greater attention to patient preparation [In cases of CM injection or Sedation administration] .
- Most CT scans require administration of an oral contrast agent to demonstrate the intestinal lumen and to distend the gastrointestinal tract.

Oral contrast media may be:

- **dilute barium suspension or a dilute water-soluble agent** may be used with equal effectiveness.
- **Air and water** are excellent as low-attenuation contrast agents.
- **Air or carbon dioxide** is frequently used to insufflate the colon for CT colonography, producing a very high negative contrast.
- **oral barium sulfate suspension** (e.g., VoLumen, Bracco Diagnostics) is sometimes used in place of positive contrast agents.
- Few institutions routinely administer **rectal contrast material**. When it is used, the most common indication is for colon cancer staging. The bladder is best appreciated on CT when filled with urine or contrast agent.

Amount:

In general, the greater the volume of oral contrast material, the better the bowel opacification.

Although a volume of at least **600 mL** is desired, patient compliance may be a limiting factor.

Precautions:

Patients should be given only clear liquids for at least 2 hours before scanning to ensure that food in the stomach is not mistaken for pathologic tissue.

Intravenous contrast agents

improve the quality of studies of the abdomen and pelvis by opacifying blood vessels, increasing the CT density of vascular abdominal organs,

improving image contrast between lesions and normal structures.

Imaging:

- **Routine imaging** image acquisition must be completed before IV contrast medium reaches the equilibrium phase and now it is done by most of the CT scanners.

- **Multiphasic imaging** is frequently used for specialized studies of the pancreas, liver, and kidney as well as in many abdominal CTA protocols.

- **A routine soft-tissue window** setting (window width approximately 450; window level approximately 50) will adequately display most abdominal anatomy.

- **the liver** may also be examined using "liver windows" that are narrower (window width approximately 150; window level approximately 70) and intended to improve the visibility of subtle liver lesions.

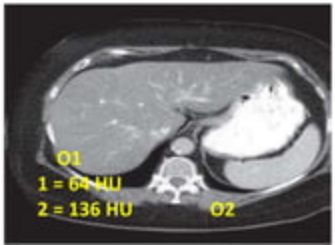
- **The lung bases** are contained in slices of the upper abdomen and must be viewed using lung windows (window width approximately 1500; window level approximately −600).

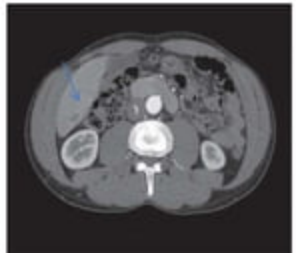
- **Bone windows** (window width approximately 2000; window level approximately 600) may help to reveal abnormalities of the bones.

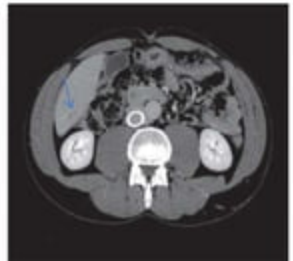
ORGAN SPECIFIC CONSIDERATIONS:

Liver normal CT attenuation of the liver in unenhanced studies varies among individuals and ranges from 38 to 70 HU. In healthy subjects the attenuation of the liver is at least 10 HU greater than that of the spleen .

- **Fatty infiltration of the liver** results in lower than normal attenuation of the liver and an abnormal attenuation difference between the liver and spleen. This is most accurately
- assessed on noncontrast CT. Many operators include an ROI of the liver and of the spleen. When the liver measurement is at **least 10 HU** lower than that of the spleen, **fatty infiltrate of the liver is indicated.**
- Most liver hemangiomas have a characteristic appearance on CT. On unenhanced CT hemangiomas appear as a **well defined hypodense mass**. After IV contrast administration the lesion shows progressive "**filling-in" enhancement** from the periphery. Eventually the lesion becomes uniformly enhanced.

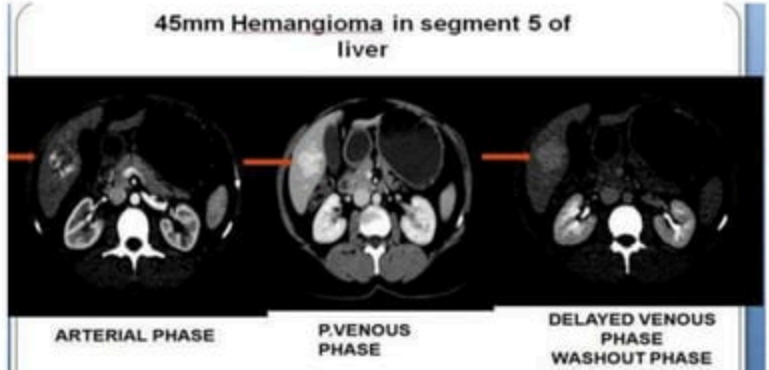






Triphasic Study

The **triple-phase liver CT protocol** is a useful examination in the assessment of focal liver lesions, hyper vascular liver metastases and endocrine tumors.
It involves a dedicated late arterial phase, portal venous phase and delayed phase acquisition. Not to be confused with a four-phase which involves the addition of a non-contrast series.



Pancreas

CT is the imaging method of choice for evaluation of the pancreas for most indications.

- The pancreas differs in size, shape, and location depending on the individual patient.
- In general, the pancreas is located between the areas of D12 (superiorly) and the L2 (inferiorly).
- **A technique** that includes the use of thin slices and IV contrast enhancement improves the likelihood of visualizing the main pancreatic duct.
- **Jaundice**---- noncontrast scans through the area of the common bile duct may allow visualization of common bile duct calculi.
- Water or low-attenuation oral contrast agents are preferred because dense contrast may obscure small stones.

Multiphasic protocols

•are common for pancreatic indications.

•Most commonly, data acquisition is timed to coincide with the late arterial phase (approximately **35 to 40 seconds after a bolus injection**) and the portal venous phase (approximately **65 to 70 seconds after a bolus injection**).

•Because the exact timing of these phases is patient-dependent, bolus-tracking software is often used.

Kidneys and Ureters

•Most renal abnormalities are best seen on CT after IV contrast medium administration.

•Unenhanced CT is generally reserved to demonstrate calcifications and calculi that may be obscured by contrast agent or it is used as a baseline for attenuation measurements when enhancement is calculated as a feature of renal mass characterization.

•MDCT is the current modality of choice for renal evaluation.

•When the examination is performed to evaluate a renal mass, scans are typically taken before the contrast bolus and at one or more phases after IV contrast administration

CT urography (CTU)

- is a relatively new imaging examination designed to provide a comprehensive evaluation of the upper and lower urinary tract.
- Many different CTU protocols are currently being used.
- CTU is defined as a diagnostic examination optimized for imaging the kidneys, ureters, and bladder.
- The examination involves the use of MDCT with thin-slice imaging, IV administration of contrast medium, and imaging in the excretory phase.
- Protocols may include only the excretory phase, or may contain as many as four phases (unenhanced, corticomedullary, nephrographic, and excretory can take 6-12 min after CM injection).
- Contrast administration is accomplished using one of two different approaches;

a single-bolus injection / a split-bolus injection.

- **A single- bolus injection** administers 100 to 150 mL of LOCM injected at a rate of 2 to 3 mL/s. scans are typically obtained in the nephrographic phase to assess the renal parenchyma and in the excretory phase to assess the urinary tract mucosa.

- **split-bolus injections** vary, but all divide the contrast media dose into two bolus injections with a delay of 2 to 15 minutes between injections; the patient is scanned once after the second injection, reducing the radiation dose; at this point, the contrast material injected first is providing excretory phase opacification and the contrast material injected second is providing renal parenchymal enhancement. The goal of the split bolus is to image a combined nephrographic-excretory phase.

- **Other techniques that may be used during CTU to optimize the visualization of the urinary tract include the use of abdominal compression bands, intravenous saline hydration (approximately 250 mL of 0.9% [normal] saline), and low-dose furosemide (Lasix) injection.**

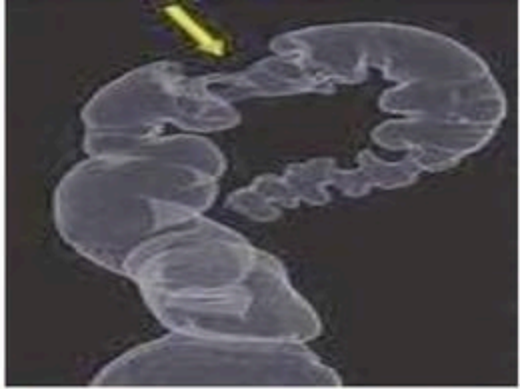
- **Multiphase CTU imaging is associated with a relatively high radiation dose. The benefit is of the examination must be carefully weighted against the risks on a patient by- patient basis.**

CT colonography (virtual CT colonoscopy)

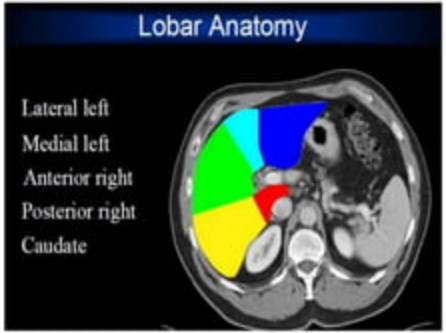
CT colonography typically refers to the evaluation of a cleansed and gas-distended colon to detect polyps and masses.

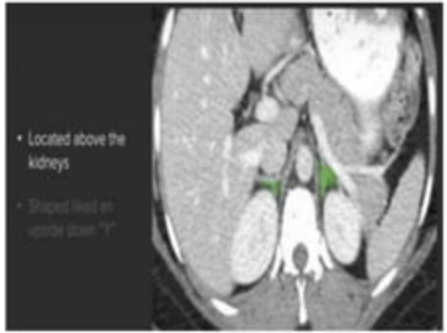
A low-dose CT is performed in both the supine and prone positions. The images are interpreted using specialized software by viewing the axial, multiplanar reconstruction (MPR), and 3D endoluminal images.

Thorough colonic cleansing is required to eliminate false-positive scans caused by fecal residue.



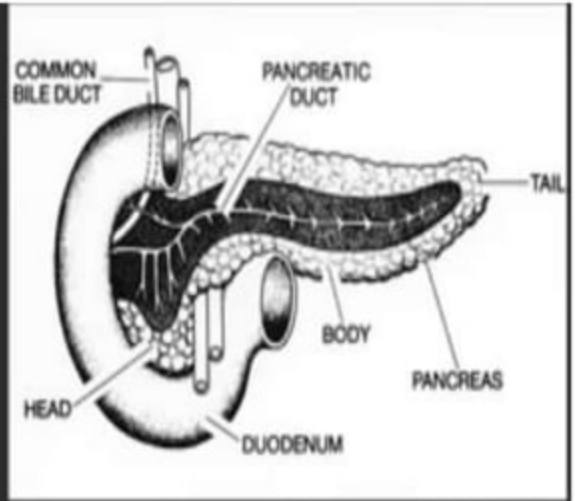
Abdominal Anatomy



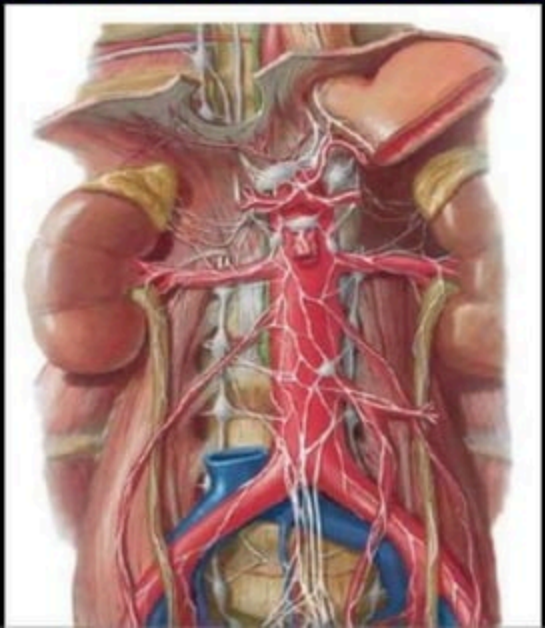


PANCREAS

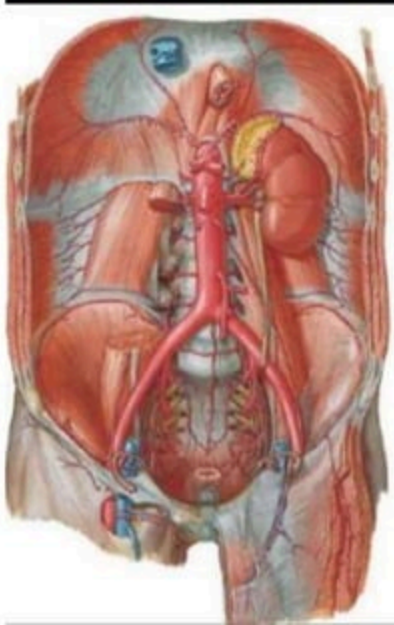
- The pancreas consists of the head, uncinate process, body and tail.
- It is located in multiple planes and cannot be seen on any one axial image.



Abdominal Vasculature

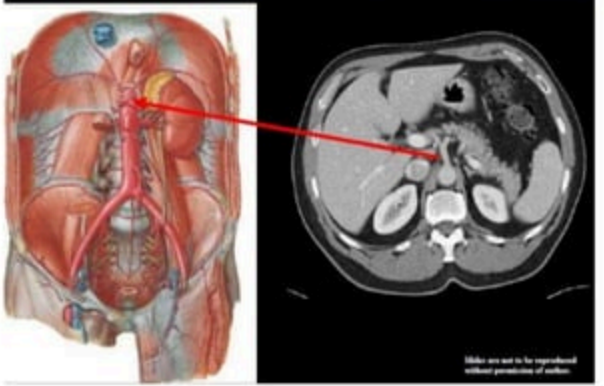


Abdominal Aorta

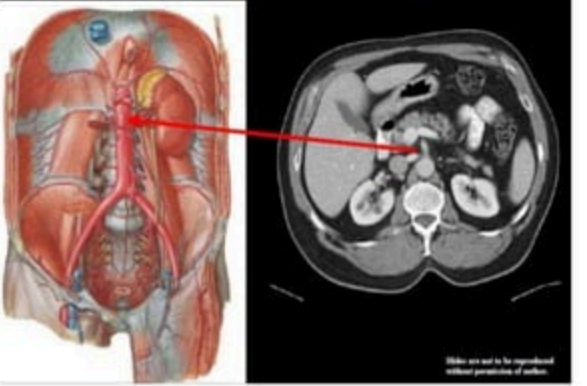


- 5 Major Branches
  - Celiac Trunk
  - Superior Mesenteric Artery
  - Renal Arteries
  - Inferior Mesenteric Artery
  - Iliac Arteries

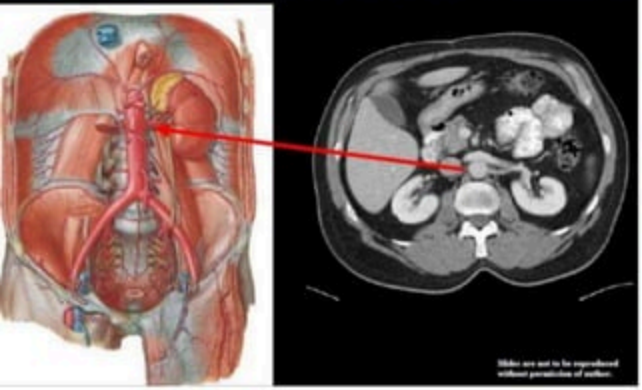
Celiac Trunk



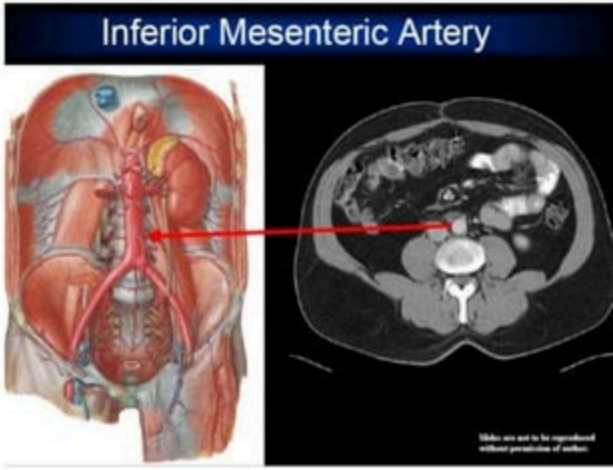
Superior Mesenteric Artery



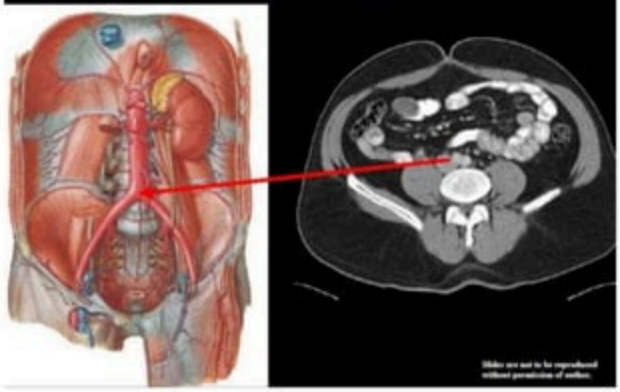
Renal Arteries



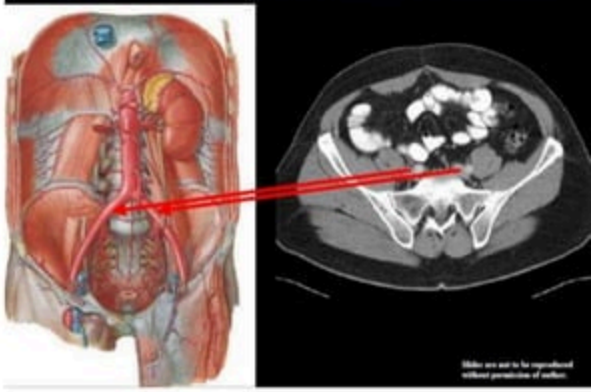
Inferior Mesenteric Artery



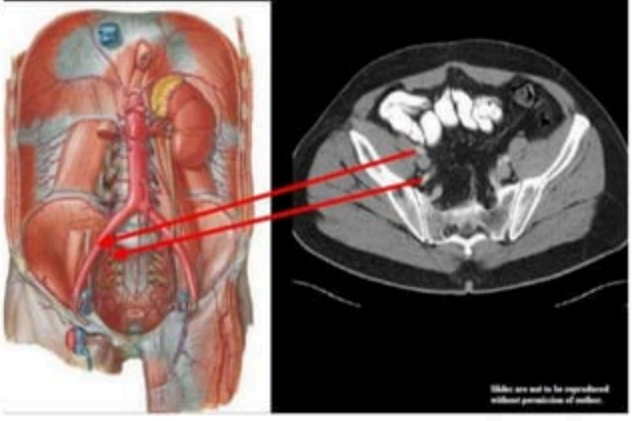
Aortic Bifurcation



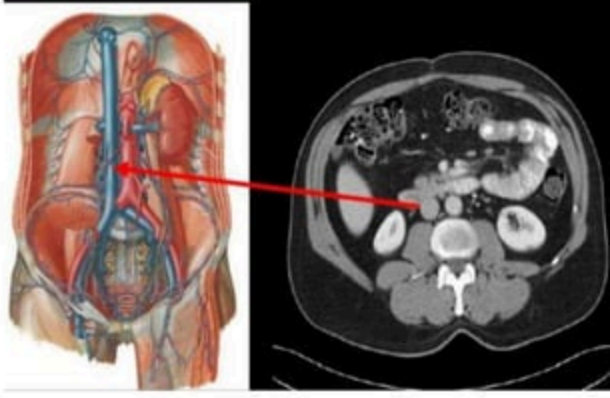
Common Iliac Arteries



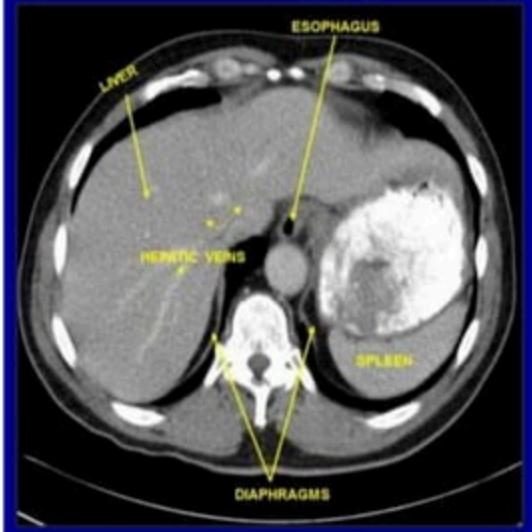
Internal and External Iliac Arteries

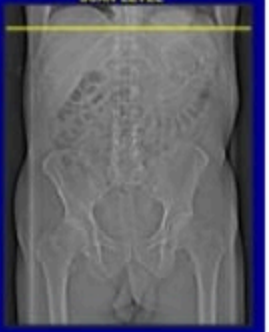


Inferior Vena Cava

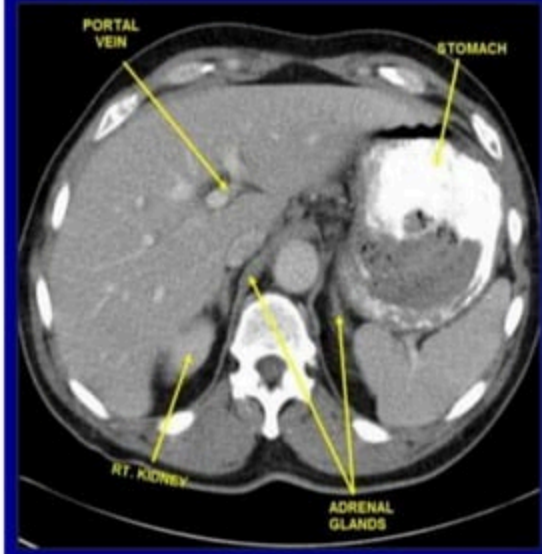


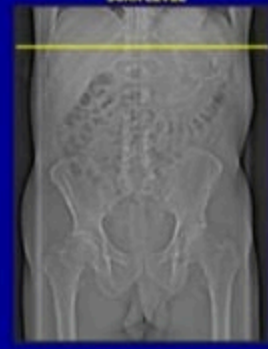
CT ABDOMEN


ESOPHAGUS
LIVER
HEPATIC VEINS
SPLEEN
DIAPHRAGMS


SCAN LEVEL

CT ABDOMEN

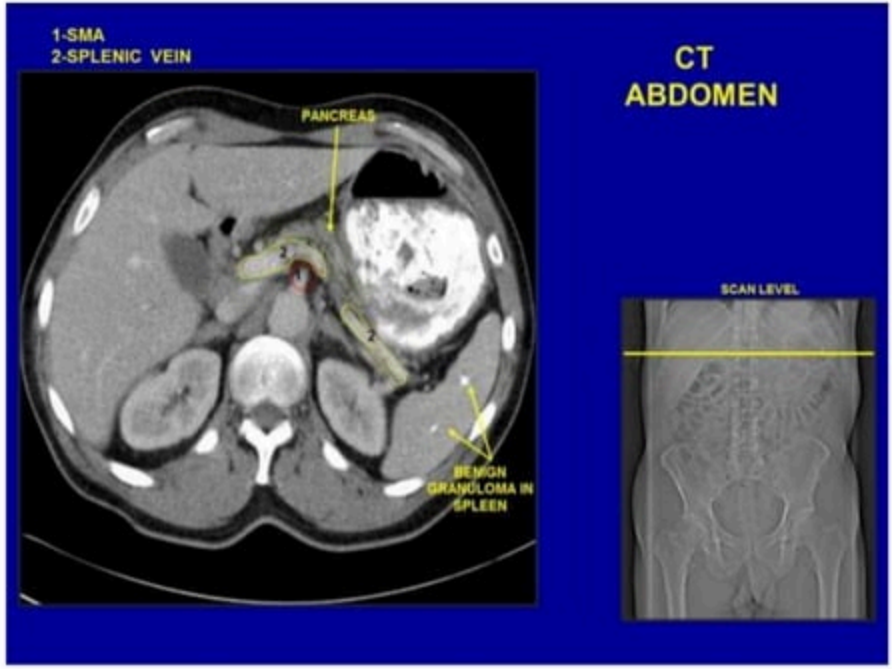




CT ABDOMEN


1-AORTA
2-CELIAC ARTERY
3-IVC
4-PORTAL VEIN
1
2
3
4
RT. KIDNEY
LT. KIDNEY

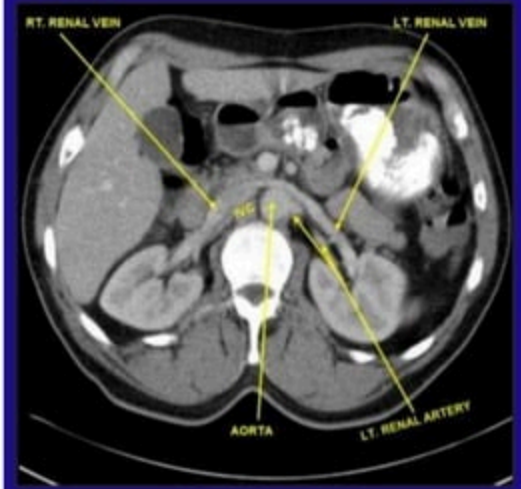

SCAN LEVEL


1-SMA
2-SPLENIC VEIN
PANCREAS
BENIGN GRANULOMA IN SPLEEN
CT ABDOMEN
SCAN LEVEL


GALLBLADDER
LIGAMENT OF TERES
GASTRIC ANTRUM AND DUODENUM
SMV
PANCREAS
SMA

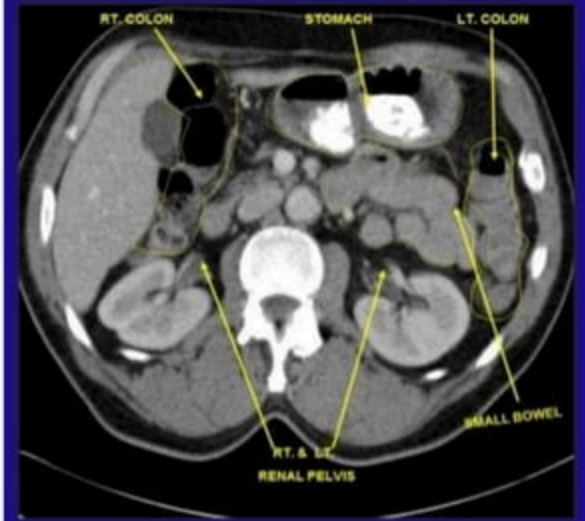

SCAN LEVEL

CT
ABDOMEN


RT. RENAL VEIN
LT. RENAL VEIN
IVC
AORTA
LT. RENAL ARTERY


SCAN LEVEL

CT
ABDOMEN


RT. COLON
STOMACH
LT. COLON
SMALL BOWEL
RT. & LT.
RENAL PELVIS


SCAN LEVEL

CT ABDOMEN


SUBCUTANEOUS FAT
TRANSVERSE COLON
IVC
AORTA
SMALL BOWEL


SCAN LEVEL

CT ABDOMEN


UMBILICUS
RT. COMMON ILIAC ARTERY
LT. COMMON ILIAC ARTERY
IVC
1
2
3
ILIAC BONE
PSOAS MUSCLES
SCAN LEVEL
1.- EXTERNAL ABDOMINAL OBLIQUE MUSCLE
2.- INTERNAL ABDOMINAL OBLIQUE MUSCLE
3.- TRANSVERSE ABDOMINIS

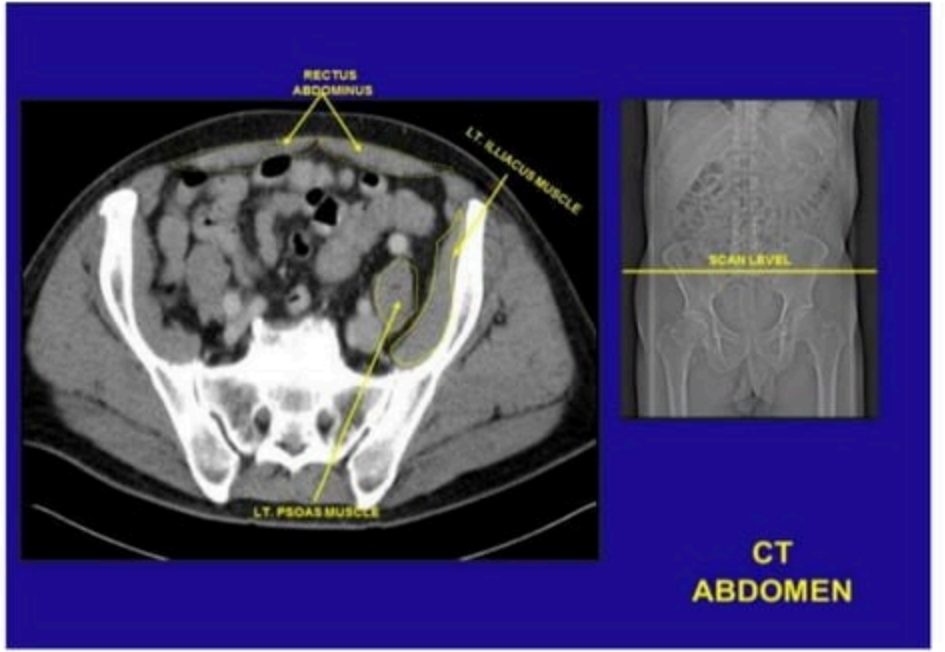

RECTUS ABDOMINUS
LT. ILLIACUS MUSCLE
LT. PSOAS MUSCLE
SCAN LEVEL
CT
ABDOMEN

Image 20. Atlas of CT Anatomy of the Abdomen. Coronal reconstruction.
1. Right lung. 2. Portal vein. 3. Liver. 4. Right colon. 5. Bladder. 6. Sigmoid colon. 7. Small intestine. 8. Superior mesenteric vein. 9. Heart.

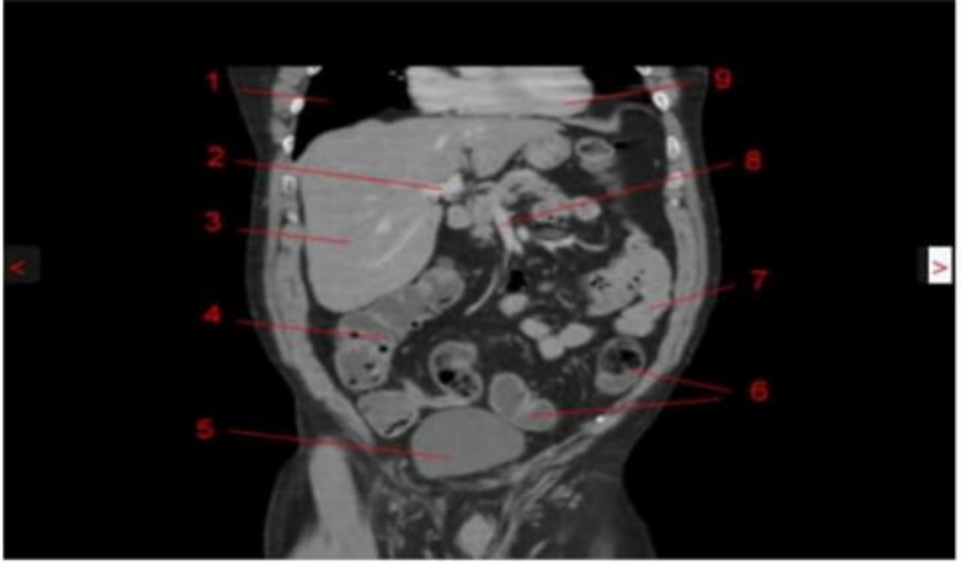
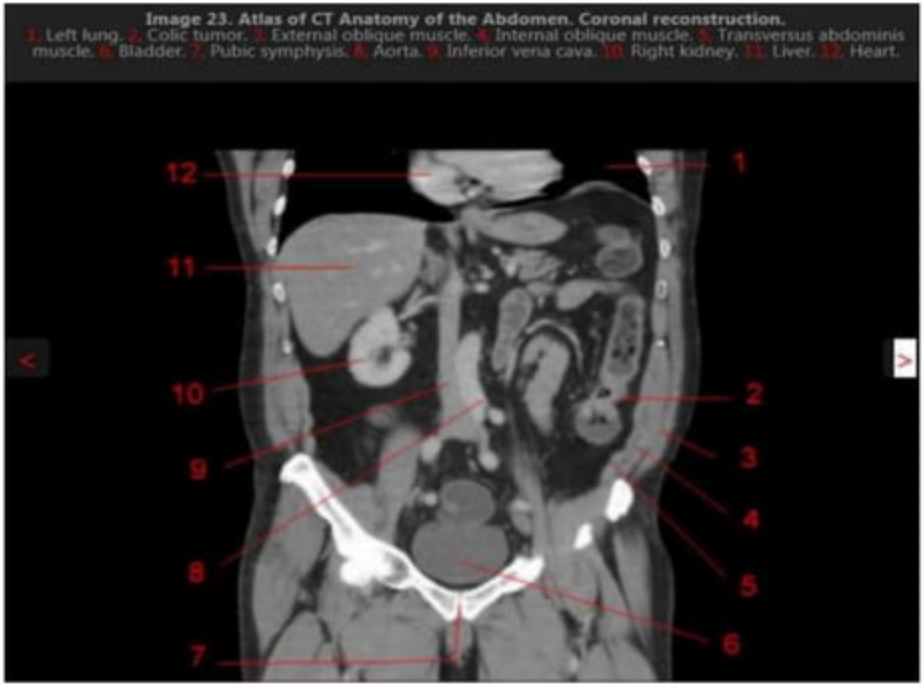


Image 23. Atlas of CT Anatomy of the Abdomen. Coronal reconstruction.
1. Left lung. 2. Colic tumor. 3. External oblique muscle. 4. Internal oblique muscle. 5. Transversus abdominis muscle. 6. Bladder. 7. Pubic symphysis. 8. Aorta. 9. Inferior vena cava. 10. Right kidney. 11. Liver. 12. Heart.




Thank You