

RADIOLOGY OF ABDOMEN

DR VALENTINA OPANCINA, MD, PHD

ASSOCIATE PROFESSOR

**DEPARTMENT OF RADIOLOGY, FACULTY OF MEDICAL
SCIENCES, UNIVERSITY OF KRAGUJEVAC**



УНИВЕРЗИТЕТ
У КРАГУЈЕВЦУ



Objectives

- ▶ RO techniques for examination of the digestive tract
- ▶ Ro anatomy of the digestive tract

❖ What radiological modalities are used in imaging the abdomen?

- ✓ **X-ray**
- ✓ **Fluoroscopy**
- ✓ **US**
- ✓ **CT scan**
- ✓ **MRI**

AXR

- ▶ **Abdominal radiography** can be useful in many settings.
- ▶ Before the advent of computed tomography (CT) imaging, it was a primary means of investigating gastrointestinal pathology and often allowed indirect evaluation of other abdominal viscera.



Indications

- ▶ Current uses for abdominal radiography include:
- ▶ a preliminary evaluation of bowel gas in an emergent setting
- ▶ evaluation of radiopaque tubes and lines
- ▶ evaluation for radiopaque foreign bodies
- ▶ evaluation for postprocedural intraperitoneal/retroperitoneal **free gas**
- ▶ monitoring the amount of bowel gas in **postoperative ileus**
- ▶ monitoring the passage of contrast through the bowel
- ▶ colonic transit studies
- ▶ monitoring renal calculi

Contraindications

- ▶ pregnancy is a relative contraindication to the use of ionizing radiation non-ionizing studies (e.g. ultrasound or MRI) should be tried first
- ▶ abdominal radiographs administer a much lower radiation dose than CT

Standard projections

- ▶ AP supine view
 - ▶ can be performed as a standalone projection or as part of an acute abdominal series
- ▶ PA erect view
 - ▶ often taken with the supine view, when used together it is a valuable projection in assessing gas-fluid levels, and free gas in the abdominal cavity.



Additional projection

lateral decubitus view

- performed as an alternative to the PA erect view to assess for free gas in the abdominal cavity



Procedure

- ▶ The patient should be gowned with minimum clothing. Radiopaque materials (zippers, belts, etc.) should be removed.
- ▶ If relevant, enteric tube suction should be avoided before the study. Ideally, the patient's bladder should be emptied as well.
- ▶ Abdominal radiographs may be obtained in the radiology department or may be performed portably. Views should generally include either the diaphragm or inferior pubic ramus. Gonadal shielding may be provided for men.
- ▶ Portable abdominal radiographs may be necessary due to patient immobility but are of much poorer quality.

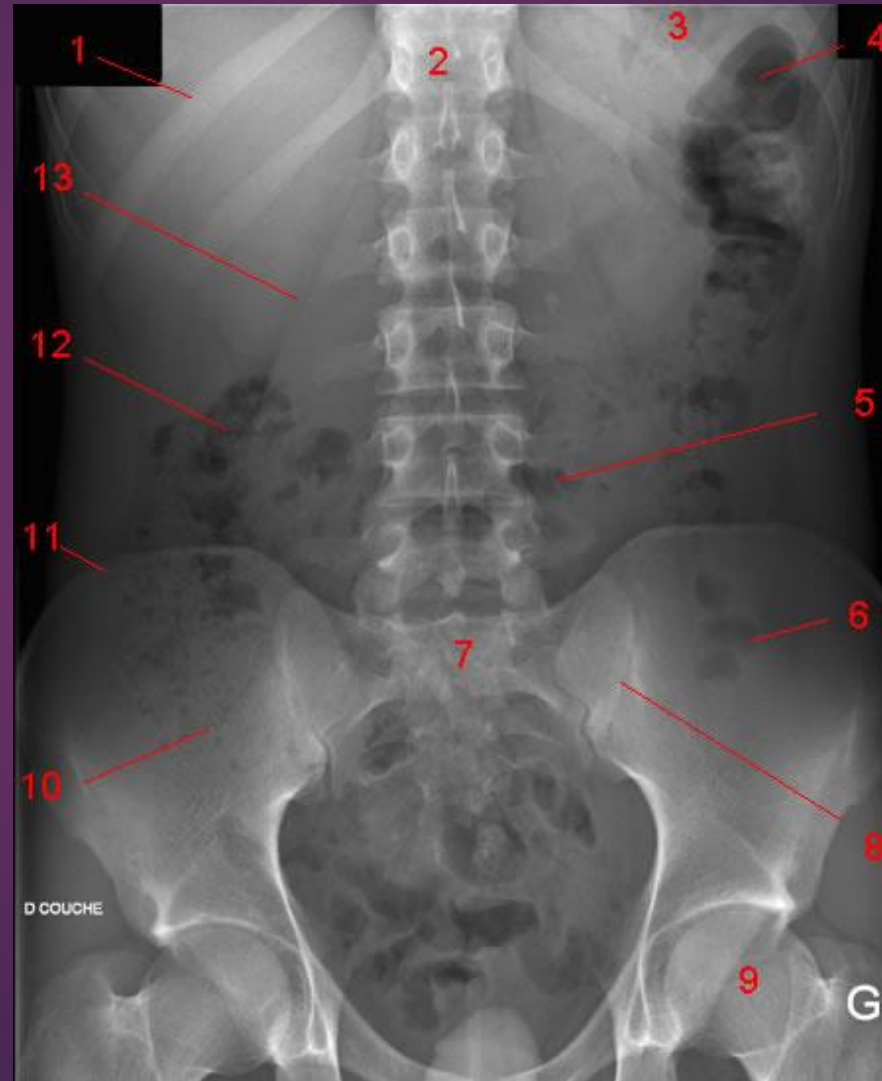
❖ ADVANTAGES:

- Widely available
- Cheap
- Excellent in diagnosing free air in the abdomen
- Good in diagnosing bowel obstruction & stones/calcifications

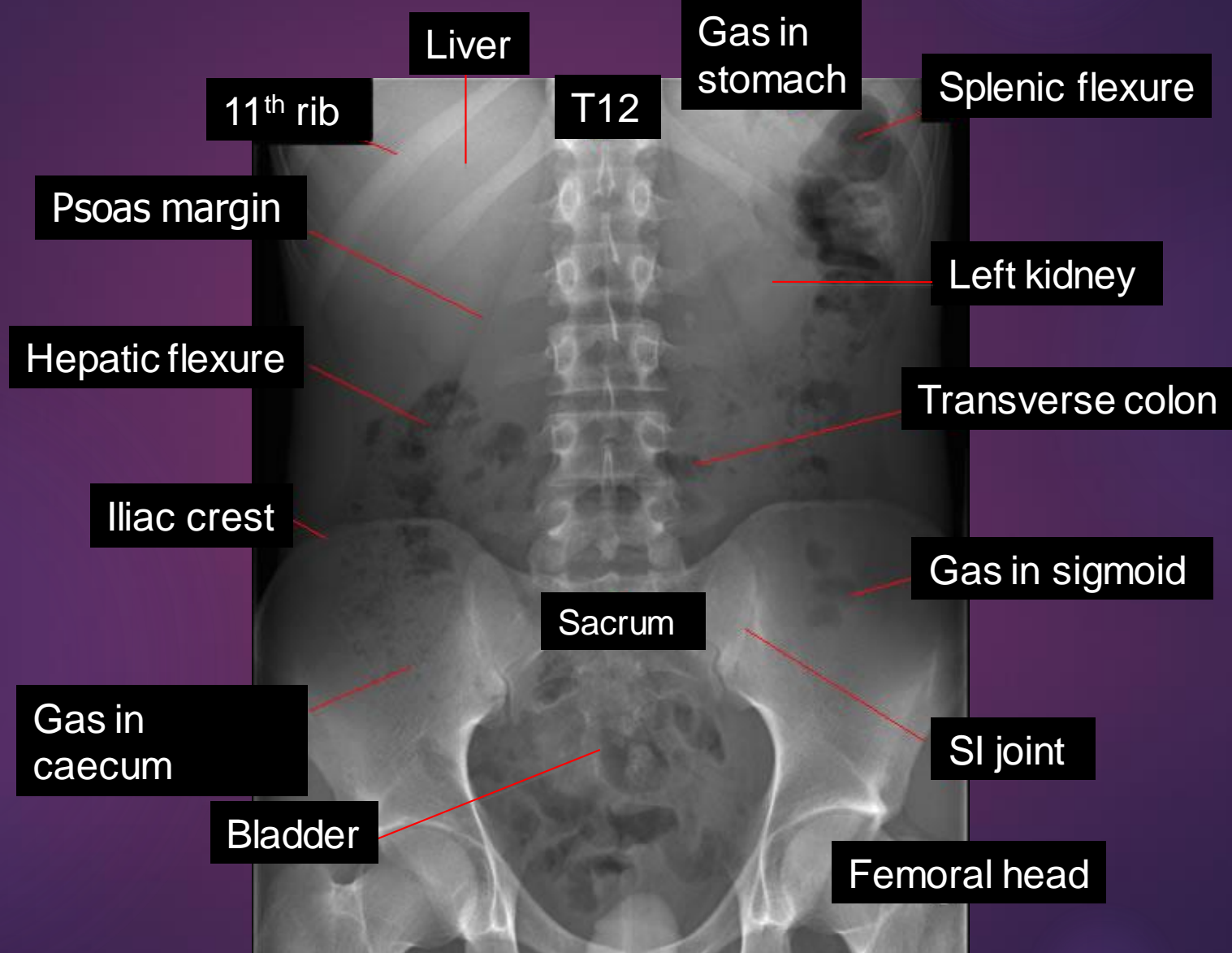
❖ DISADVANTAGES:

- Radiation
- Poor soft tissue details

Normal AXR



Normal AXR



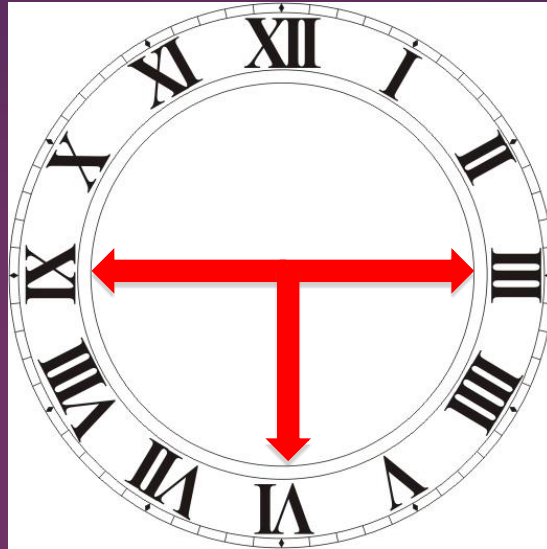
First step of reading an Abdominal X-ray is assessing **gas pattern**

What is normal?

- ▶ **Stomach**
 - ▶ Almost always air in stomach
- ▶ **Small bowel**
 - ▶ Usually small amount of air in 2 or 3 loops
- ▶ **Large bowel**
 - ▶ Almost always air in rectum and sigmoid
 - ▶ Varying amount of gas in rest of large bowel



3, 6, 9 RULE



Maximum Normal Diameter of bowel

Small bowel 3cm

Large bowel 6cm

Caecum 9cm

GAS PATTERNS

▶ NORMAL ABDOMINAL RADIOGRAPHS

- ▶ In the supine abdominal radiograph gas is normally present in the body of the stomach and in variable amounts in the transverse and other parts of the colon. It is also present in small amounts in the small intestine of adults. Normal gas-fluid levels are usually seen in the gastric fundus on erect radiographs and occasionally in the first part of the duodenum and in the caecum. In infants and children gaseous distension of the stomach and of the intestines is a common feature. In infants in particular this is largely due to swallowed air. Supine abdominal radiographs occasionally show apparent soft tissue masses in the gastric fundus or duodenal loop; these are well-recognised 'pseudo-tumours' and are due to normal fluid collections gravitating to these dependent areas.

▶ ABNORMAL GAS PATTERNS

- ▶ Abnormal gas patterns in abdominal radiographs may be conveniently classified into:
 - ▶ *excessive intestinal gas*
 - ▶ *abnormal contour of gas-containing loops*
 - ▶ *extraluminal gas.*

Excessive intestinal gas

Causes	Radiological features
Physiological Air-swallowing, usually in children	Non-specific gaseous distension. No consistent end-point to suggest obstruction
Mechanical obstruction Small bowel, e.g. adhesions, hernia, Crohn's disease	Gaseous distension of loops of small bowel which lie centrally. Valvulae conniventes visible. Short fluid levels on erect film.
Large bowel, e.g. carcinoma, diverticular disease with stricture	Distension of peripherally situated large bowel, proximal to obstruction. Haustra visible. Longer fluid levels than in small bowel
Volvulus of the caecum, sigmoid	Specific radiological signs. Extremely dilated loops extending upwards from normal site of these structures to lie in upper quadrants. Very long fluid levels in erect film
Non-mechanical obstruction (or pseudo-obstruction). Generalised ileus, e.g. following surgery, peritonitis, metabolic disorders	Large and small bowel distended. May resemble mechanical obstruction
Localised ileus, e.g. appendicitis, pancreatitis, abscess, ischaemia	Single loop of dilated bowel (sentinel loop). Speckled gas in abscess

Abnormal contour of gas-containing loops

Causes	Radiological features
Crohn's disease	Affects small or large bowel, or both. Stricture may be visible, or irregularity of mucosa due to ulceration May show signs of obstruction or toxic megacolon (see below)
Ulcerative colitis	Narrowed, featureless empty colon. Pseudopolypi may be visible as filling defects. Gross dilatation - 'toxic megacolon' is a dangerous complication and predisposes to perforation
Ischaemia	Dilated bowel, thickened wall with areas of oedema 'thumb-printing'. Ileus, with signs of obstruction
Intrinsic masses	Tumours and intussusception may be outlined by gas
Displaced loops	Large non-alimentary abdominal masses, e.g. enlarged spleen, may displace or indent gas-filled loops of otherwise normal bowel

Extraluminal gas

Causes	Radiological features
Intraperitoneal Perforation of a hollow viscus	Variable amounts of gas, from small crescent under diaphragm (erect film) to gross peritoneal distension
Subphrenic abscess	Air-fluid level under diaphragm. Adjacent lung base consolidation. Confirm with ultrasound
Bowel wall Infarction, necrotising enterocolitis in infants	Linear streaks of gas in bowel wall. May coalesce or outline portal vein radicles
Pneumatosis coli	Blebs of gas in colon wall. Symptoms may mimic carcinoma. Usually elderly patient with airways obstruction
Biliary tree After sphincterotomy or anastomosis between biliary tree and bowel	Branching gas pattern in liver (bile ducts). Usually lie centrally in liver; gas in portal vein radicles extends more peripherally
Erosion of gallstone into small bowel; erosion of duodenal ulcer into biliary tree; pancreatic neoplasm; gas-forming infection	Small bowel obstruction ('gallstone ileus') and opaque calculus may be visible in intestine with gas in biliary tree. Other causes listed do not cause intestinal obstruction
Genitourinary tract Fistula, e.g. trauma, postoperative, Crohn's disease	Gas may outline urinary bladder, ureters and collecting systems. Differential diagnosis: gas-forming infection in diabetic patients

ABDOMINAL CALCIFICATION

- ▶ Many structures in the abdomen calcify, especially in older subjects; most of these are of no clinical significance. They include the walls of blood vessels, lymph nodes and costal cartilages. Calcification may also occur in pathological states but may be discovered coincidentally. Gallstones and prostatic calcification fall into this category. Those that are often associated with symptoms include calcified urinary calculi, pancreatic calcification in chronic pancreatitis, and calcification occurring in abdominal tumours

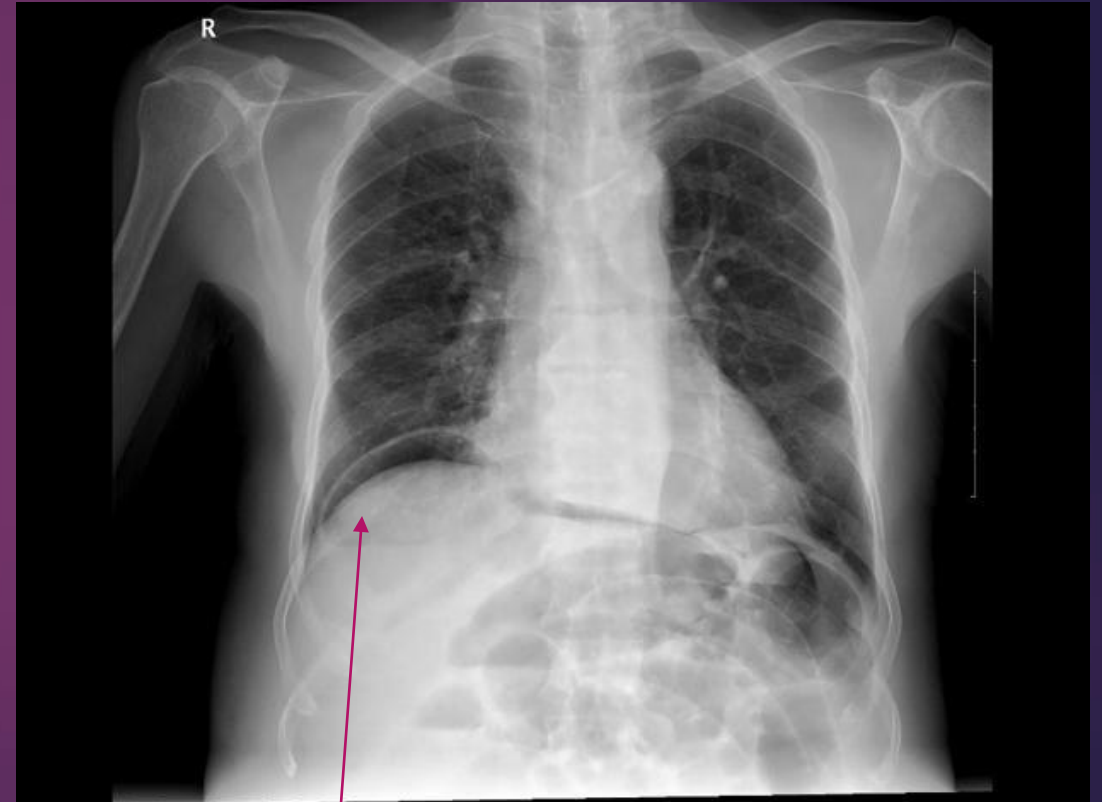
Pneumoperitoneum

Pneumoperitoneum describes gas within the peritoneal cavity, often due to critical illness. There are numerous causes and several mimics.

- ▶ The causes and, hence, the corresponding severity of accompanying illness, are variable:
- ▶ perforated hollow viscus
 - ▶ peptic ulcer disease
 - ▶ ischemic bowel
 - ▶ bowel obstruction
 - ▶ necrotizing enterocolitis
 - ▶ appendicitis
 - ▶ diverticulitis
 - ▶ malignancy
 - ▶ inflammatory bowel disease
 - ▶ mechanical perforation

CXR

- ▶ An erect chest x-ray is probably the most sensitive plain radiograph for the detection of free intraperitoneal gas. If a large volume pneumoperitoneum is present, it may be superimposed over a normally aerated lung with normal lung markings.
- ▶ subdiaphragmatic free gas
- ▶ leaping dolphin sign



AXR

- ▶ Free gas within the peritoneal cavity can be detected on an abdominal radiograph.



Adynamic ileus

- ▶ **Adynamic ileus** is the failure of passage of enteric contents through the small bowel and colon that are not mechanically obstructed. Essentially it represents the paralysis of intestinal motility.
- ▶ Adynamic ileus can be caused by a number of conditions:
- ▶ drugs: e.g. opioids
- ▶ metabolic: e.g. hyponatremia
- ▶ sepsis: especially gram-negative bacteria
- ▶ abdominal trauma or surgery (see below)
- ▶ myocardial infarction / congestive heart failure
- ▶ head injury or neurosurgery
- ▶ intra-abdominal inflammation and peritonitis
- ▶ retroperitoneal hematoma

Postoperative ileus vs. paralytic ileus

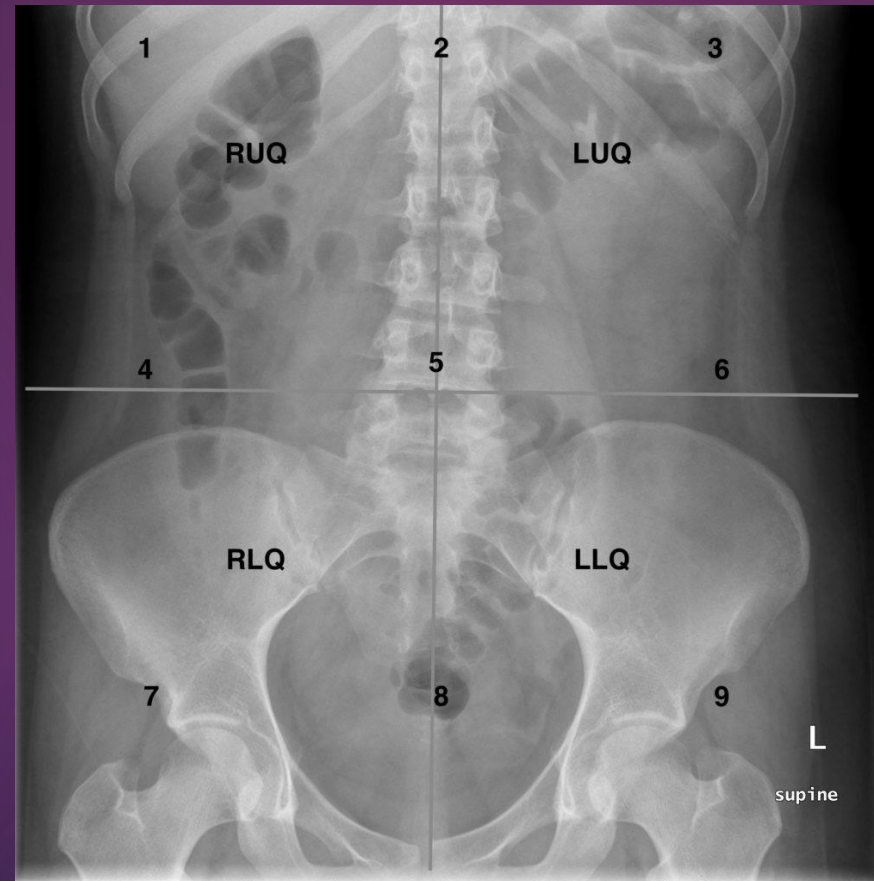
- ▶ Some degree of ileus is a normal and expected finding after abdominal surgery, including C-section⁹. Conventional recovery times have been reported at⁴:
 - ▶ small intestine: 0-24 hours
 - ▶ stomach: 24-48 hours
 - ▶ colon: 48-72 hours
- ▶ These intervals, however, may be overestimations⁵.
- ▶ Prolonged postoperative ileus (>72 hours) has been termed "paralytic" ileus by some and is concerning for small bowel obstruction, bowel perforation, peritonitis, and intra-abdominal abscess.
- ▶ Improving postoperative ileus is often determined clinically as much as radiographically, with the resumption of oral intake and flatus.

AXR

- ▶ generalized, uniform, gaseous distension of the large and small bowel
 - ▶ involvement of large bowel and lack of a transition point help distinguish it from small bowel obstruction
- ▶ when localized, there may be a sentinel loop
- ▶ Air fluid levels



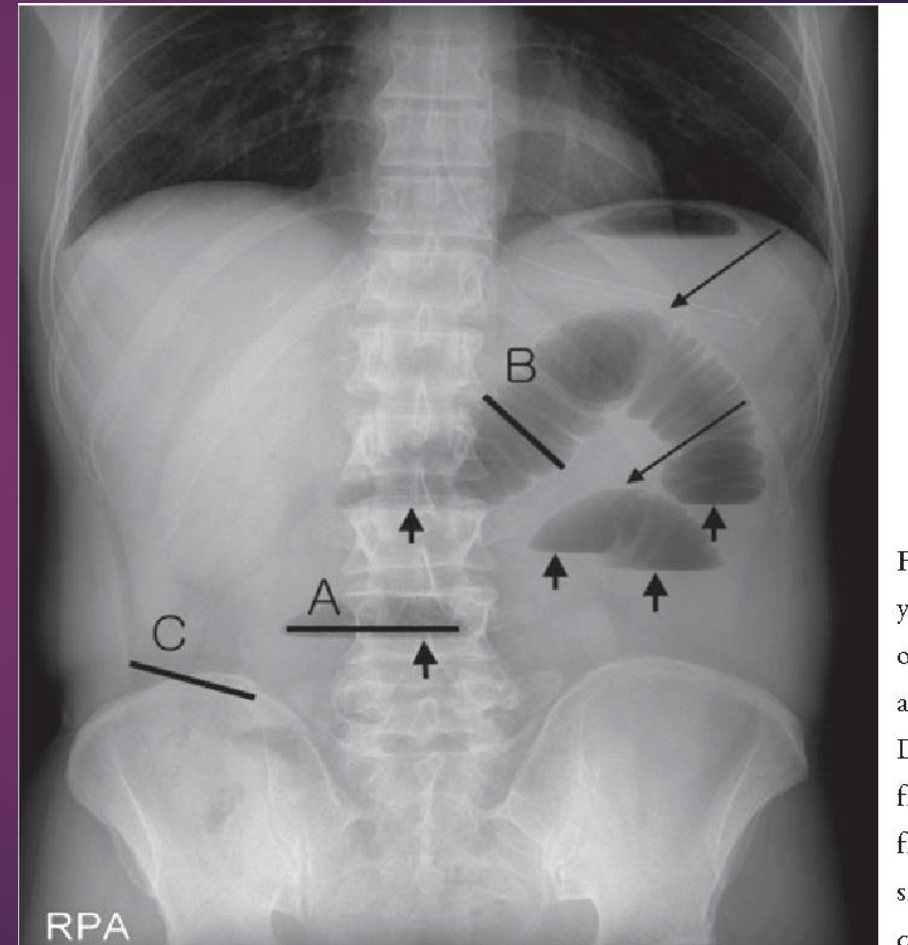
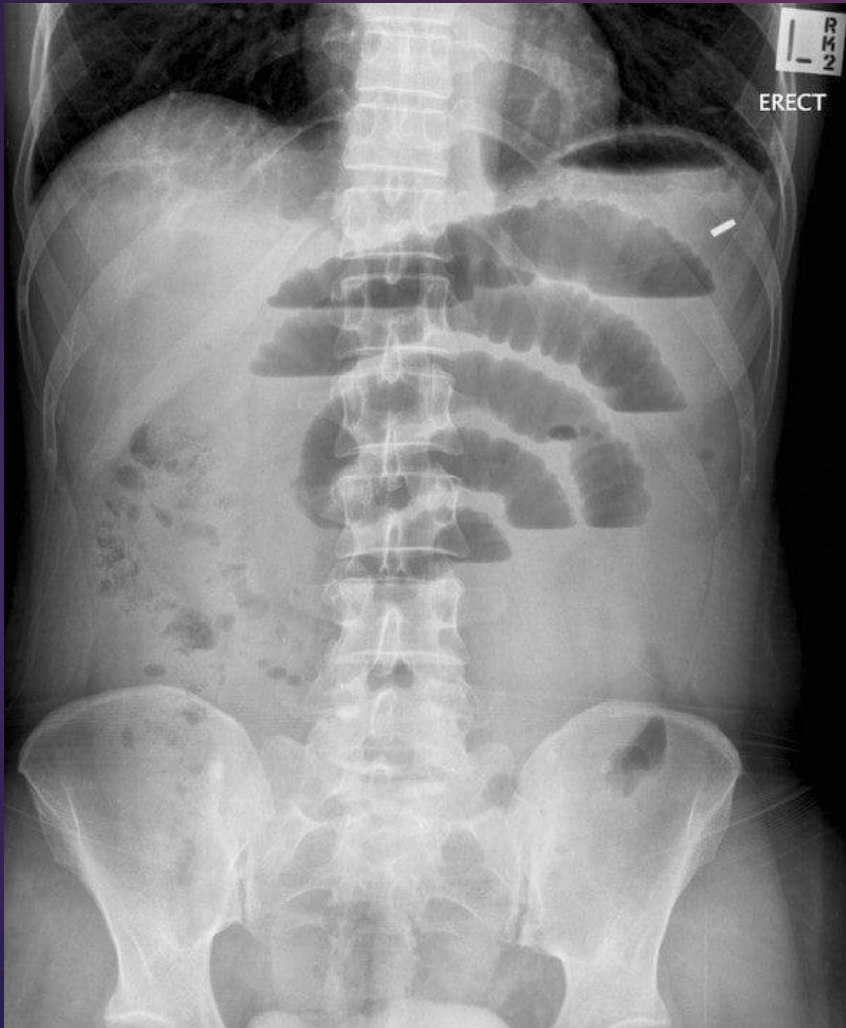
How to divide abdomen into 4 quadrants:



Colon obstruction: air fluid levels



Small intestine obstruction

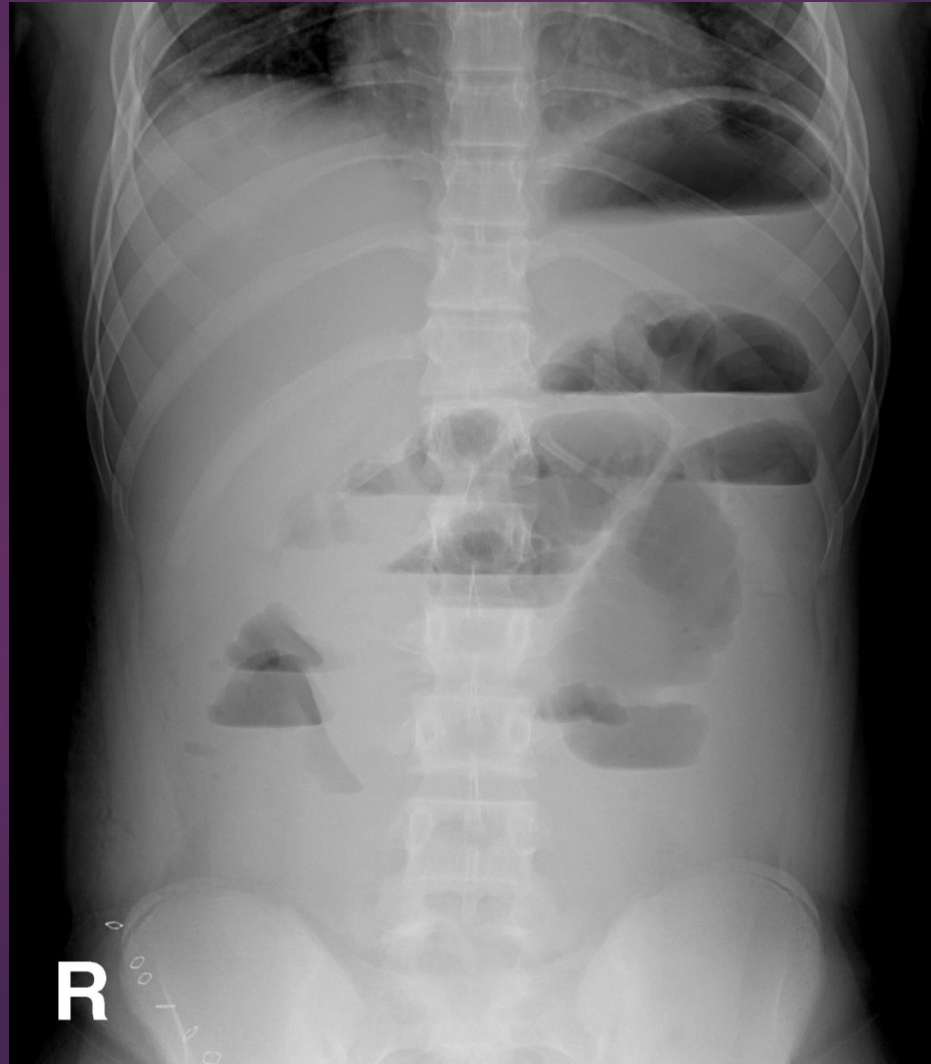


Mechanical small bowel obstruction

Mechanical SBO causes:

- 1-Adhesion from previous abdominal surgery (most common cause)
- 2-hernias containing bowel
- 3-neoplasm

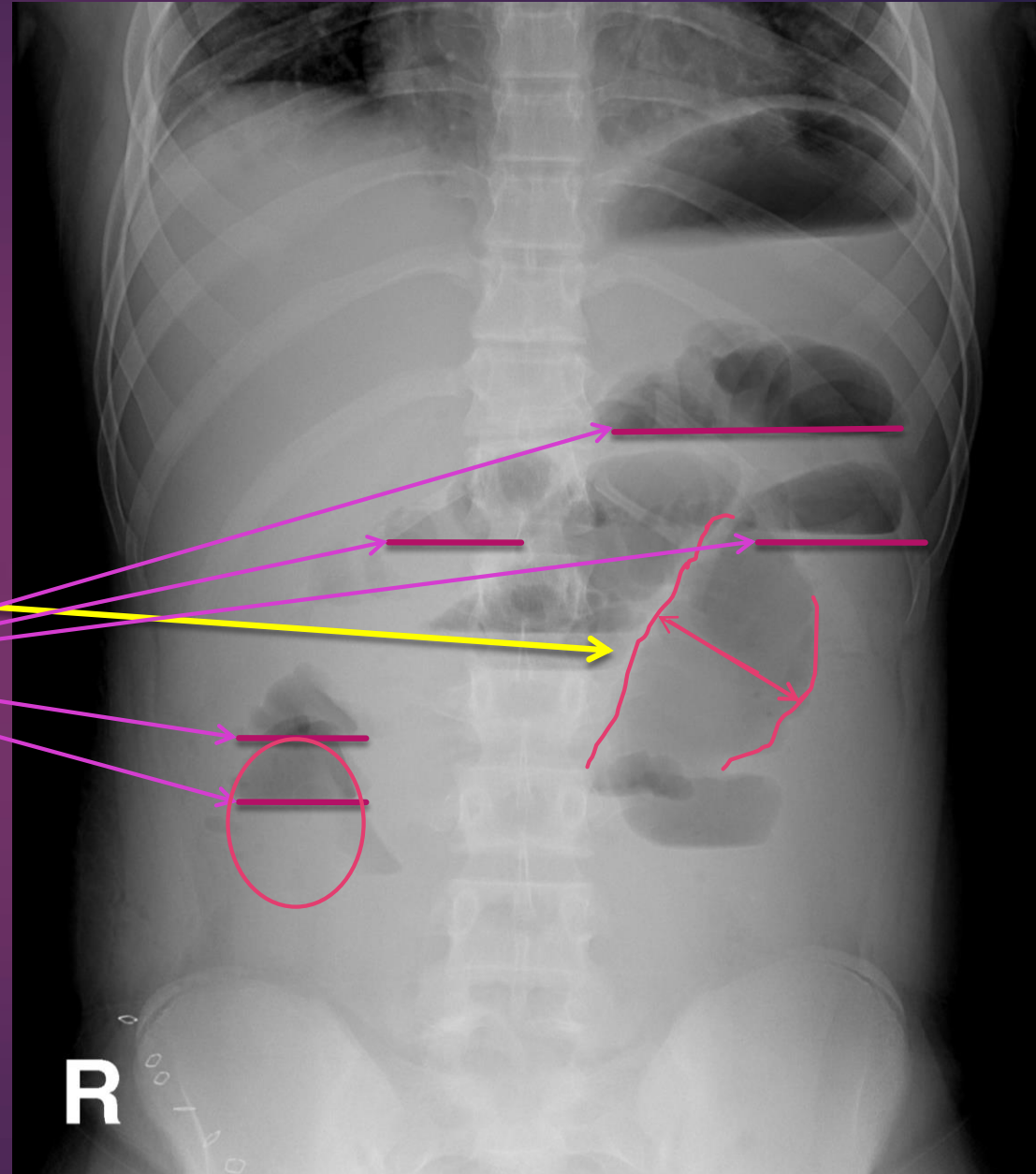
Is this X ray normal or abnormal ? and Why?



It is **ABNORMAL**

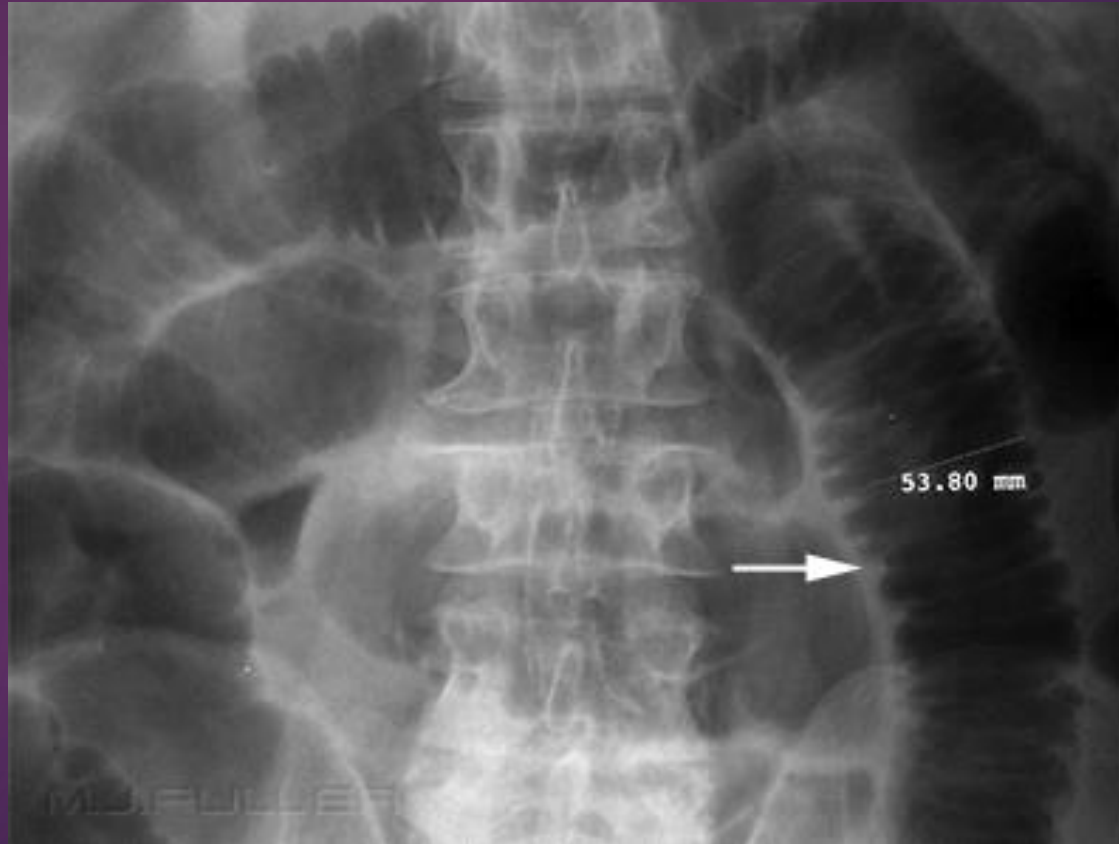
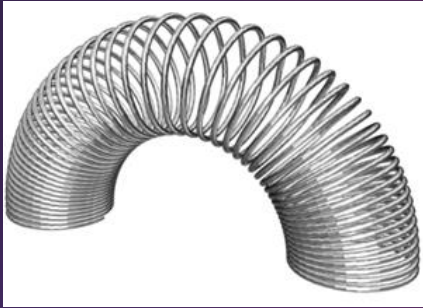
S Small bowel obstruction

- Dilated bowel loops
- Air fluid levels



Loops arrange themselves from left upper to right lower quadrant in distal SBO

Coil spring



Double Bubble Sign



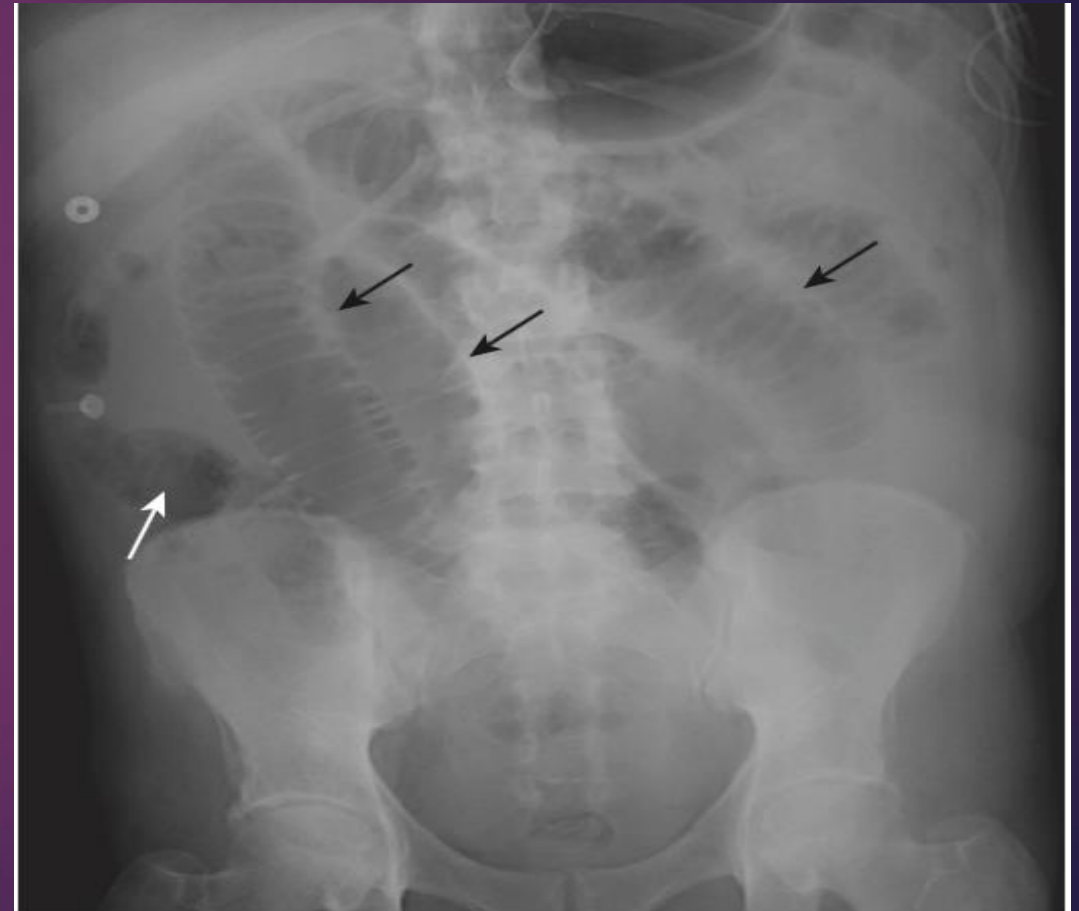
Duodenal Atresia



How to differentiate between small and large bowel on X-ray

The **small bowel is centrally placed** in the abdomen.

- ▶ **Valvular markings typically extend across the lumen** of the small bowel from one wall to the other. The **valvulae are spaced much closer together**.
- ▶ The **small bowel can achieve a maximum diameter, when abnormally dilated, of about 5 cm**. The **large bowel can dilate to many times that size**.



Causes of Mechanical LBO

Causes of Large bowel obstruction:

- 1-Tumor (carcinoma)
- 2-Hernia
- 3-Volvulus
- 4-Diverticulitis
- 5-Intussusception

Mechanical LBO

- ▶ Colon dilates from point of obstruction backwards
- ▶ Little/no air fluid levels (colon reabsorbs water)
- ▶ Little or no air in rectum/sigmoid



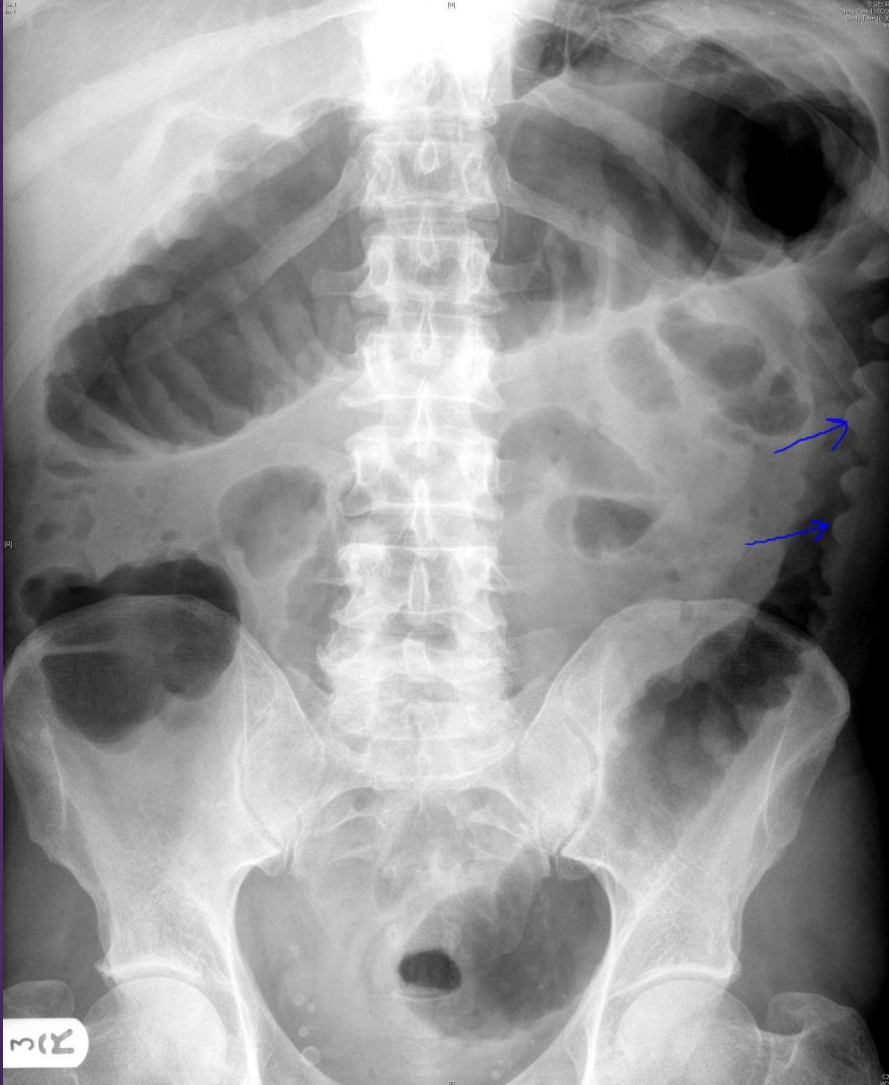
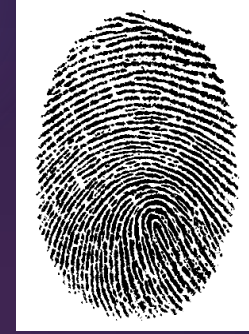
Coffee Bean Sign

Sigmoid volvulus

Massively
dilated
sigmoid loop



Thumbprinting



The distance between loops of bowel is increased due to thickening of the bowel wall.

The haustral folds are very thick, leading to a sign known as 'thumbprinting.'

Extraluminal air

- ▶ Second step is reading an abdominal X-ray is assessing for extra luminal Air
 - Pneumoperitoneum

Upright film best

- ▶ The patient should be positioned sitting upright for 10-20 minutes prior to acquiring the erect chest X-ray image.
- ▶ This allows any free intra-abdominal gas to rise up, forming a crescent beneath the diaphragm. It is said that as little as 1ml of gas can be detected in this way.

Signs of free air

- ▶ Crescent sign
- ▶ Riglers sign
- ▶ Football sign
- ▶ Falciform ligament sign

Crescent Sign

Free air under the diaphragm



Best demonstrated on
upright chest x rays or
left lat decub

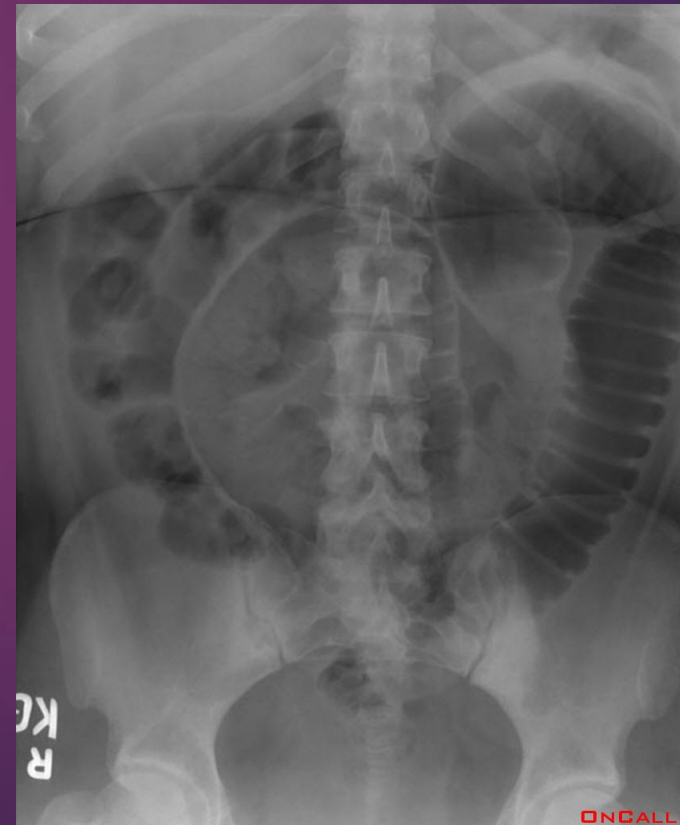
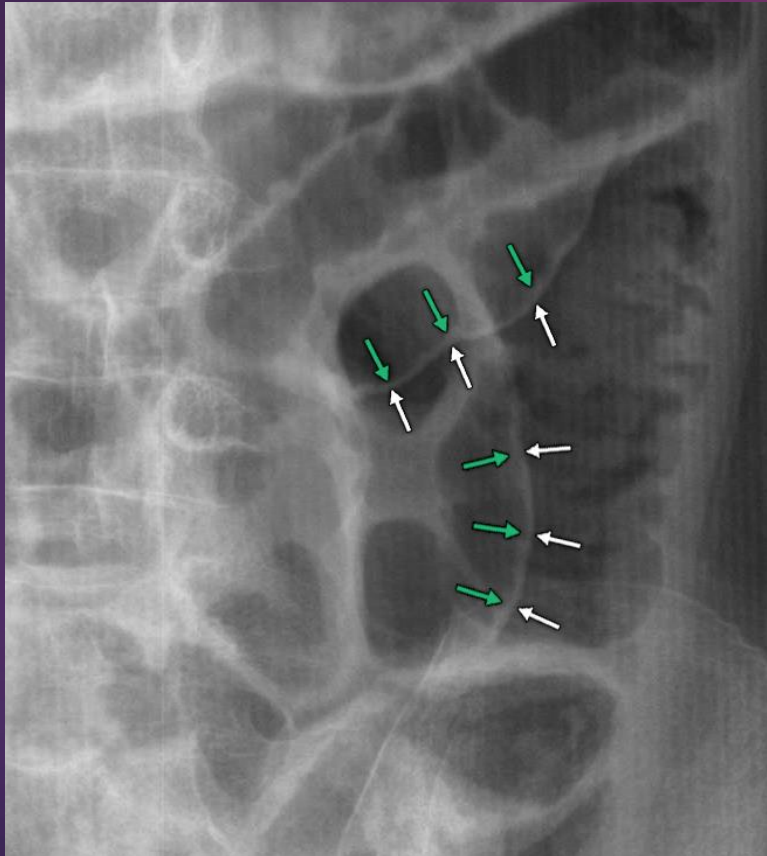
Easier to see under
right diaphragm ? Why?

Rigler's Sign

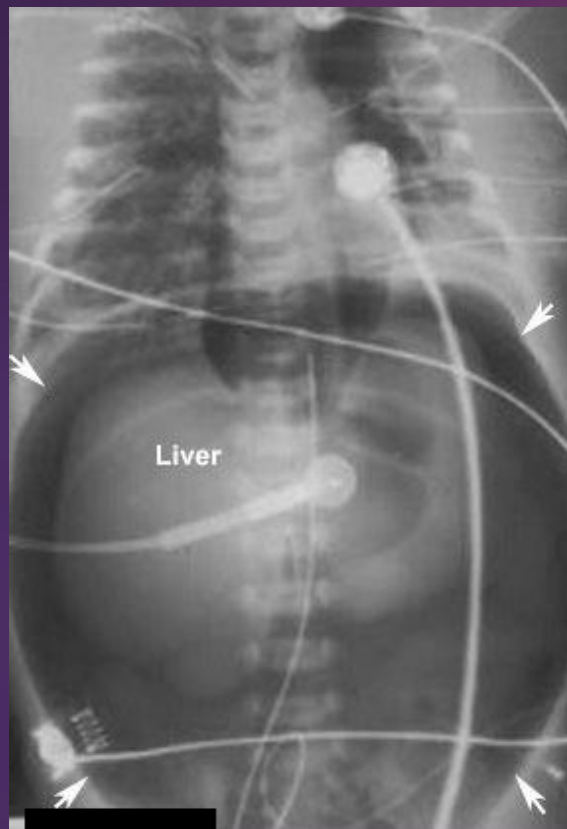
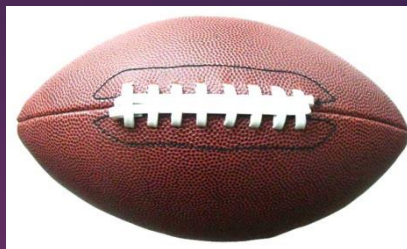
Bowel wall visualised on both sides due to intra and extraluminal air

Usually large amounts of free air

May be confused with overlapping loops of bowel, confirm with upright view



Football Sign



Paediatric

Seen with massive
pneumoperitoneum

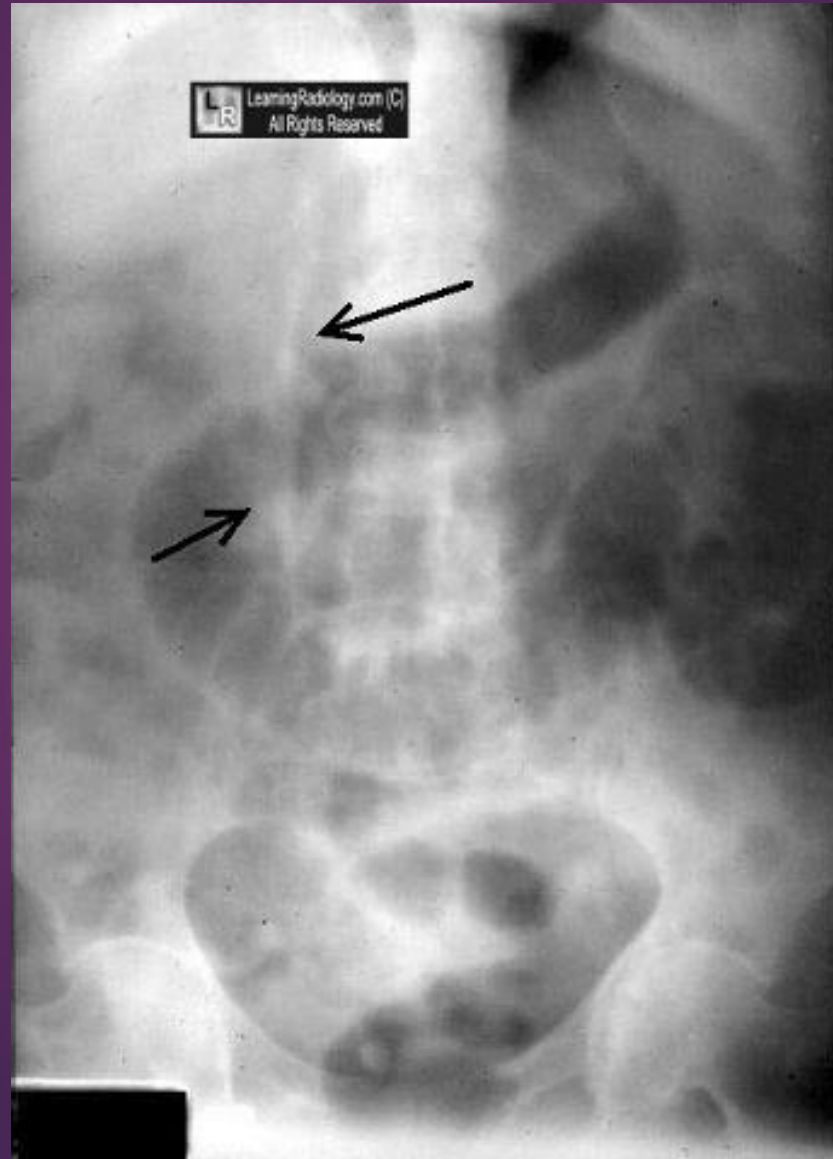
Most often in children
with necrotising
enterocolitis

In supine position
air collects anterior
to abdominal
viscera



Adult

Falciform ligament sign



Normally
invisible.

Supine film, free
air rises over
anterior surface
of liver

Checking for calcifications

3rd step in reading an x-ray

Renal calculi



Pelvicalyceal calcifications

Staghorn Calcification



Tubular



Renal stones are often small, but if large can fill the renal pelvis or a calyx, taking on its shape which is likened to a staghorn.

Bladder calculi

Lamellar



Fluoroscopy



X-RAY

+



**ORAL
CONTRAST**

Barium swallow -----> Esophagus

Barium meal -----> Stomach

Barium follow through -----> Small bowel

Barium enema -----> Large bowel

BARIUM MEAL

- ▶ The standard double-contrast study of the upper gastrointestinal tract includes views of the oesophagus, stomach and duodenum.
- ▶ The examination is carried out following a period of starvation; peristalsis is temporarily abolished using an injection of glucagon or an atropine-like agent. This enhances mucosal coating with barium suspension and allows detection of small mucosal lesions, e.g. erosions and polyps. The radiographs obtained are examined for evidence of ulceration, deformity, infiltration, stricture formation, external compression or displacement, and obstruction.
- ▶ The major advantage of endoscopy in the investigation of alimentary disorders is the ability of the operator to obtain biopsies of lesions or suspicious mucosal abnormalities. Sources of bleeding can also be identified accurately. Endoscopy is not without complications and it has been claimed that good barium studies are as accurate as endoscopy in the detection of significant lesions.
- ▶ What has become apparent over recent years is that many benign and malignant diseases of the gastrointestinal tract cause similar or identical radiological signs, and that some benign lesions become, or harbour, malignant disease.
- ▶ Disorders such as achalasia, peptic and corrosive strictures of the oesophagus, gastric ulcers and certain non-epithelial sub-mucosal tumours, such as leiomyomas, predispose to, or undergo, malignant transformation into malignant tumours. Therefore direct inspection of the lesions, obtaining biopsies where necessary, is an accepted way of following up some lesions such as gastric ulcers. It is also known that malignant ulcers undergo cyclical healing changes and may therefore mimic benign ulcers.
- ▶ Finally, benign ulcers may cause marked localised fibrosis and deformity when they heal. This change is usually permanent and should not be the sole justification for further follow-up using barium studies.

❖ ADVANTAGES:

- Available
- Relatively cheap
- **Excellent** in evaluation the bowel **lumen and mucosa**

❖ DISADVANTAGES:

- Radiation **highest** of all modalities
- Poor in evaluating extra luminal pathologies

❖ INDICATIONS

- Assessing the mucosal outline
- Abdominal pain
- Gastro esophageal reflux
- Masses
- Inflammatory bowel diseases
- Post surgical, leak

❖ CONTRAINDICATIONS:

- Pregnancy
- Bowel obstruction
- Bowel perforation (with barium type of contrast)



BARIUM SWALLOW



BARIUM MEAL



BARIUM FOLLOW THROUGH



BARIUM ENEMA

What is abnormal in this barium enema?

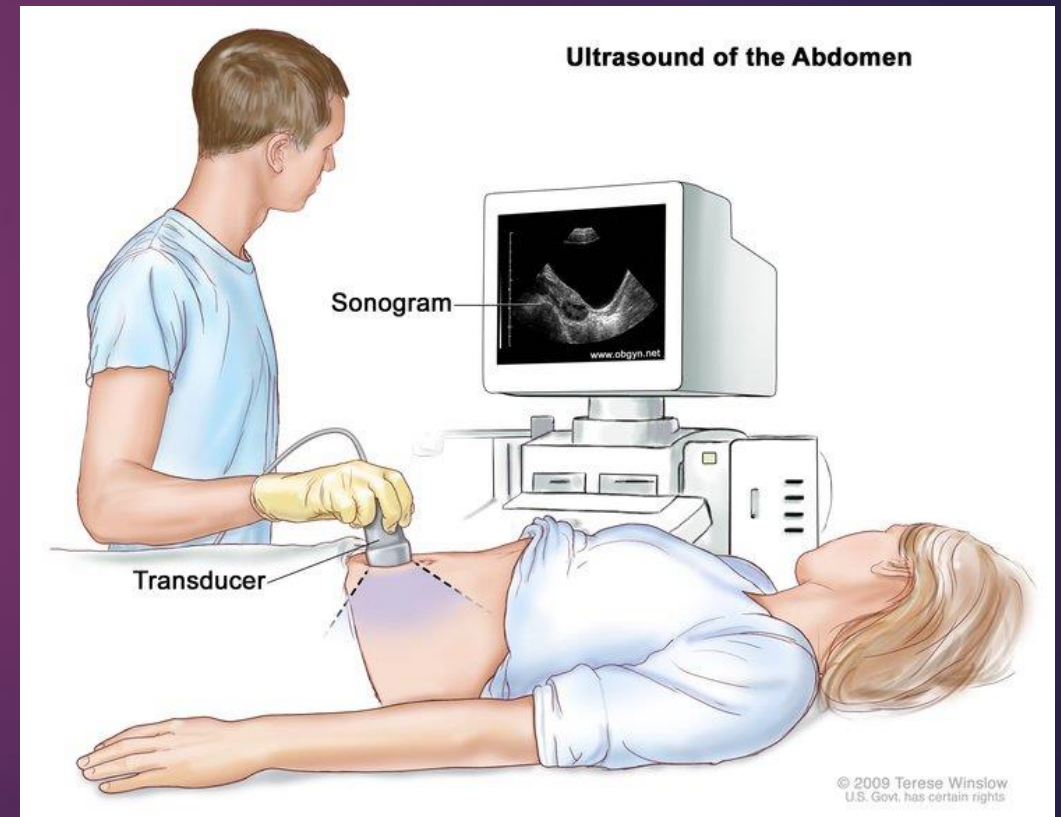


Colon mass/malignancy (Apple core appearance)



ULTRASOUND OF ABDOMEN

Abdominal ultrasound is a diagnostic imaging technique that evaluates the organs and structures in the abdomen, including the liver, gallbladder, pancreas, spleen, adrenal glands, kidneys, and abdominal aorta.



Normal ultrasound anatomy

On an ultrasound, the normal anatomy of the liver appears as a homogeneous, hypoechoic or isoechoic structure with a smooth surface, showing diffusely increased echogenicity relative to the spleen. The following features are typical of normal ultrasound anatomy of the liver:

- location: The liver is located in the right upper quadrant of the abdomen
- size: The liver is approximately 15 cm in length and 10-12 cm in width at its widest point
- segments: The liver is divided into eight segments and each segment has its own blood supply and drainage
- lobes: The liver is divided into two main lobes, the right and left lobes

▶ **indications**

- ▶ abdominal pain
- ▶ altered liver function tests
- ▶ jaundice
- ▶ renal symptoms (consider renal US)

▶ **important pathology**

- ▶ gallstone disease
- ▶ acute cholecystitis
- ▶ renal tract calculi
- ▶ abdominal aortic aneurysm

▶ **benefits**

- ▶ quick and accessible
- ▶ no radiation

▶ **limitations**

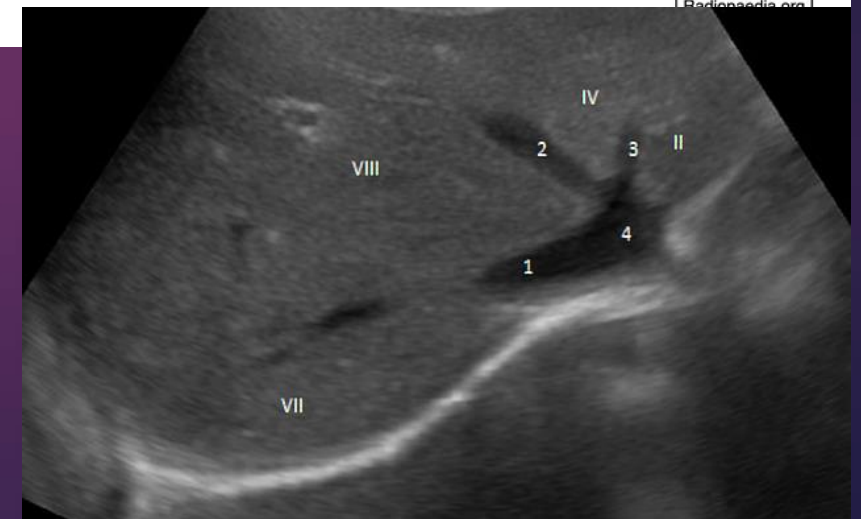
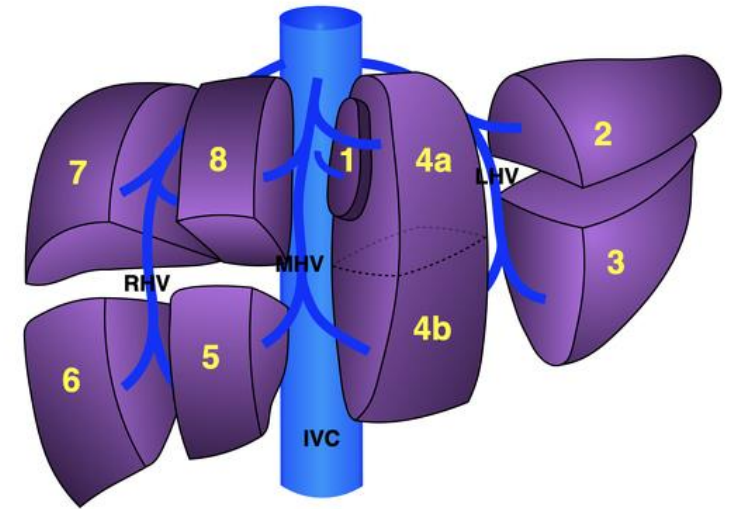
- ▶ operator dependent
- ▶ large patients can be challenging to image with ultrasound

▶ **procedure**

- ▶ patient fasted for 4 hours
 - ▶ maximizes distension of the gallbladder
 - ▶ not required post cholecystectomy
- ▶ patient scanned supine
 - ▶ oblique and lateral positions may be used during the study

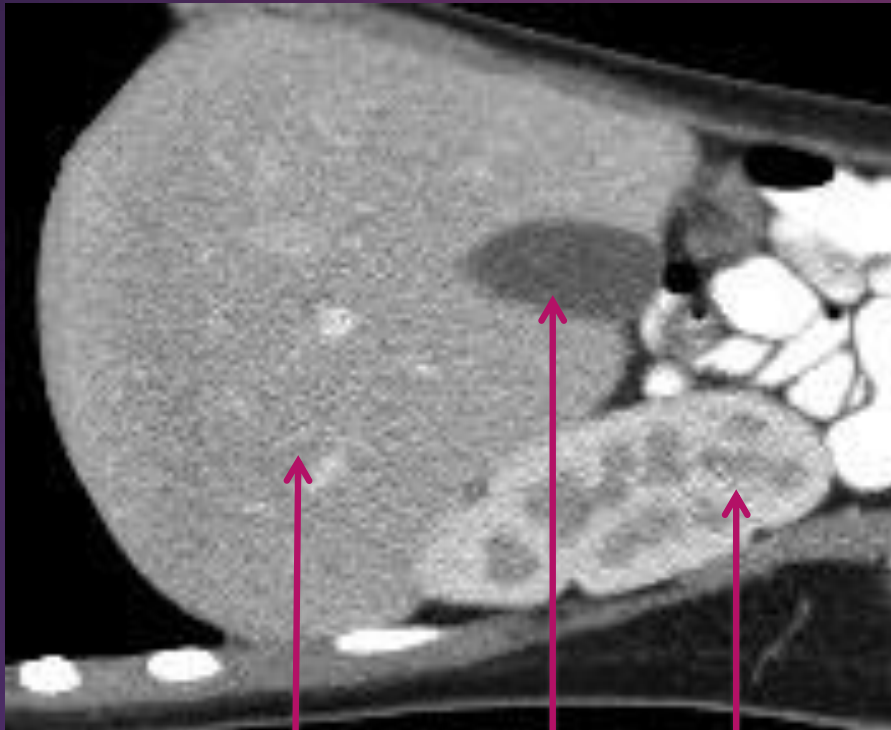
Couinaud segments

- 4 segments, and each segment is supplied by a specific branch of the hepatic artery and portal vein
- vasculature: The portal vein, hepatic artery, and hepatic veins are visible on an ultrasound
- biliary system: The bile ducts, including the common bile duct and the intrahepatic ducts, are visible on an ultrasound



Liver/gallbladder

CT – sagittal cut

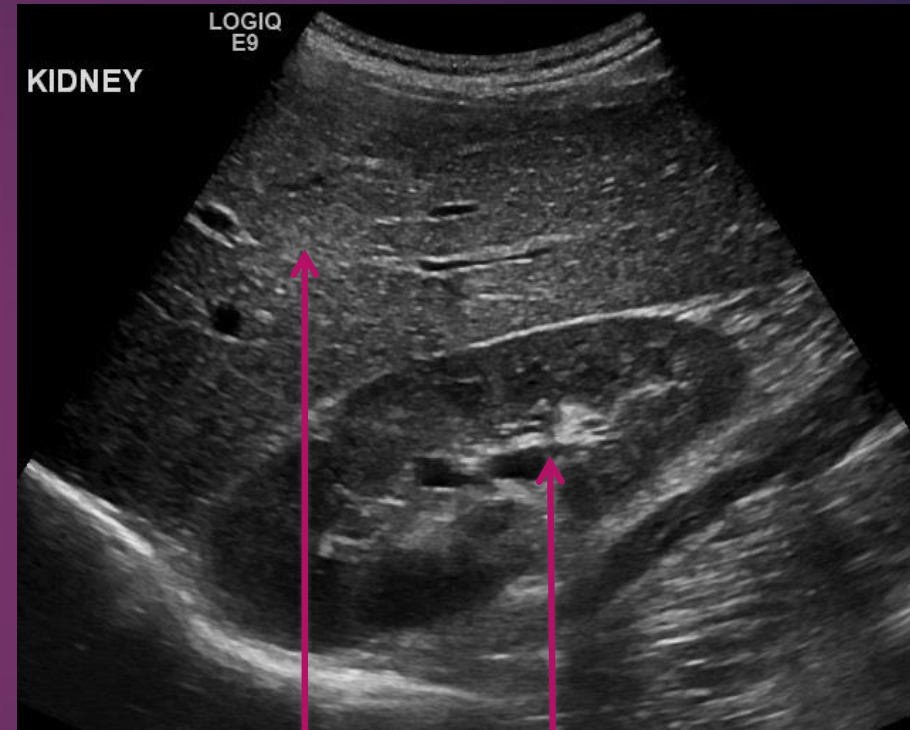


Liver

Gallbladder

Right kidney

U/S – longitudinal orientation



Liver

Right kidney

Liver/gallbladder

CT – axial cut



Right, middle, and left hepatic veins

Draining into the IVC

U/S – transverse orientation

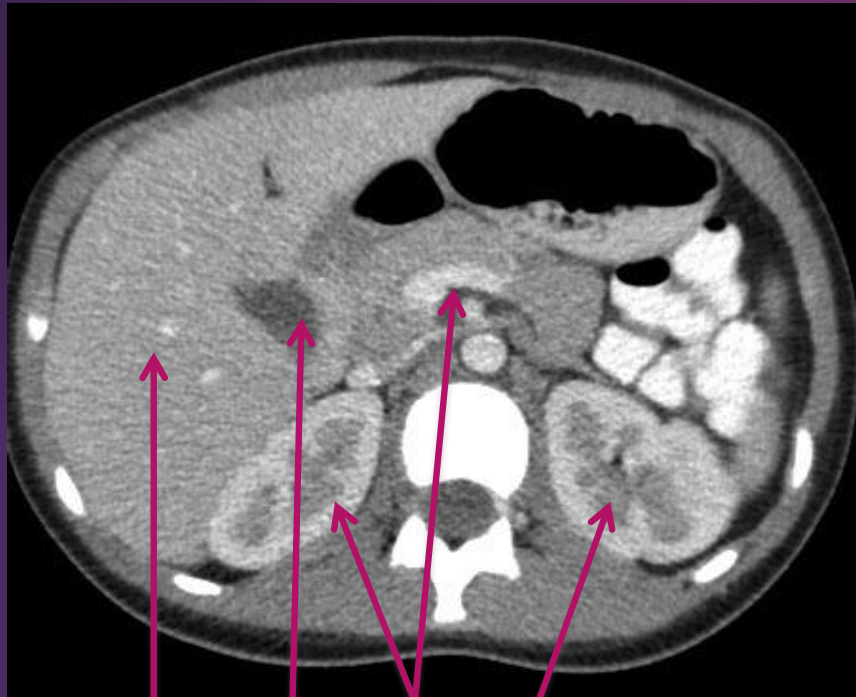


Right, middle, and left hepatic veins

Draining into the IVC

Liver/gallbladder

CT – axial cut



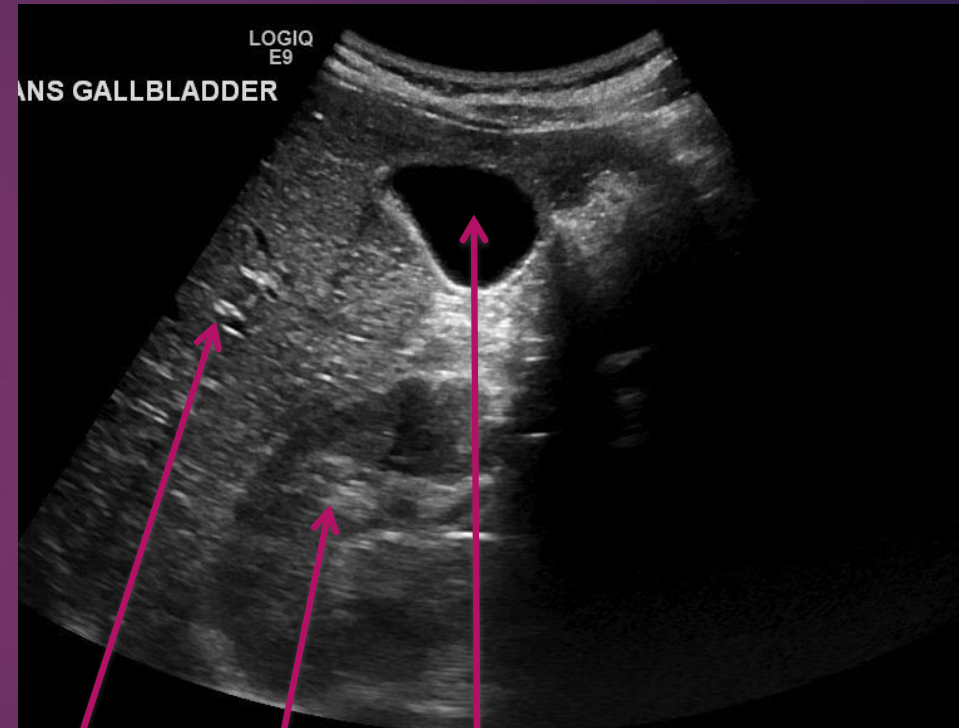
Liver

Gallbladder

Kidneys

Splenic vein

U/S – transverse orientation



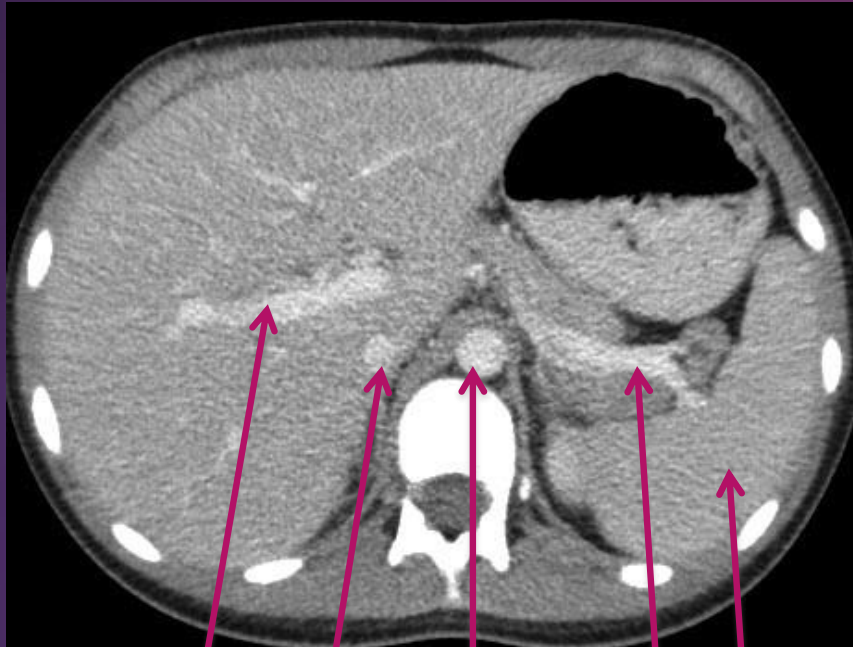
Liver

Right kidney

Gallbladder

Liver/gallbladder

CT – axial cut



Right portal vein

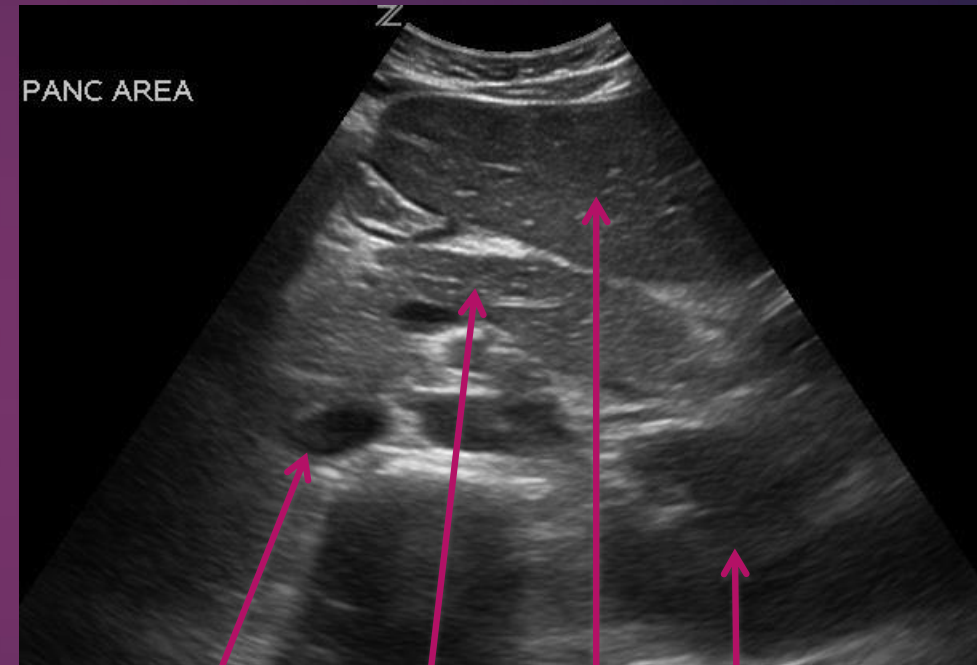
Splenic vein

Aorta

Spleen

IVC

U/S – transverse orientation



PANC AREA

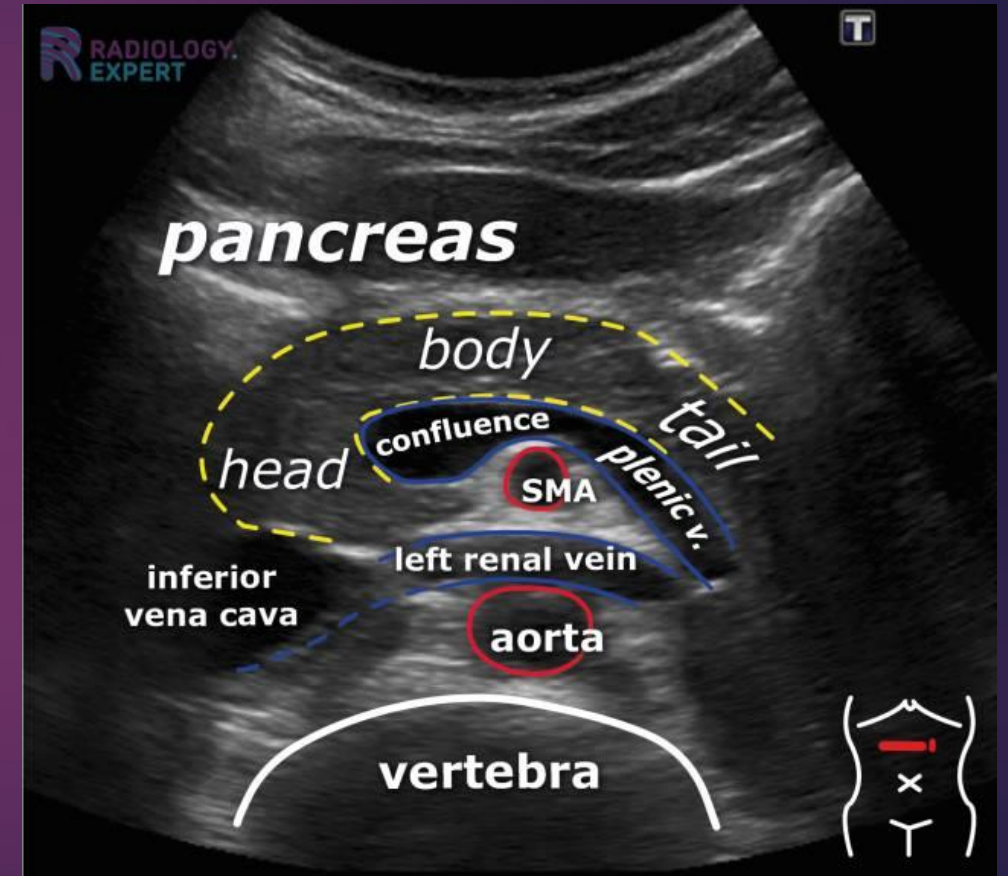
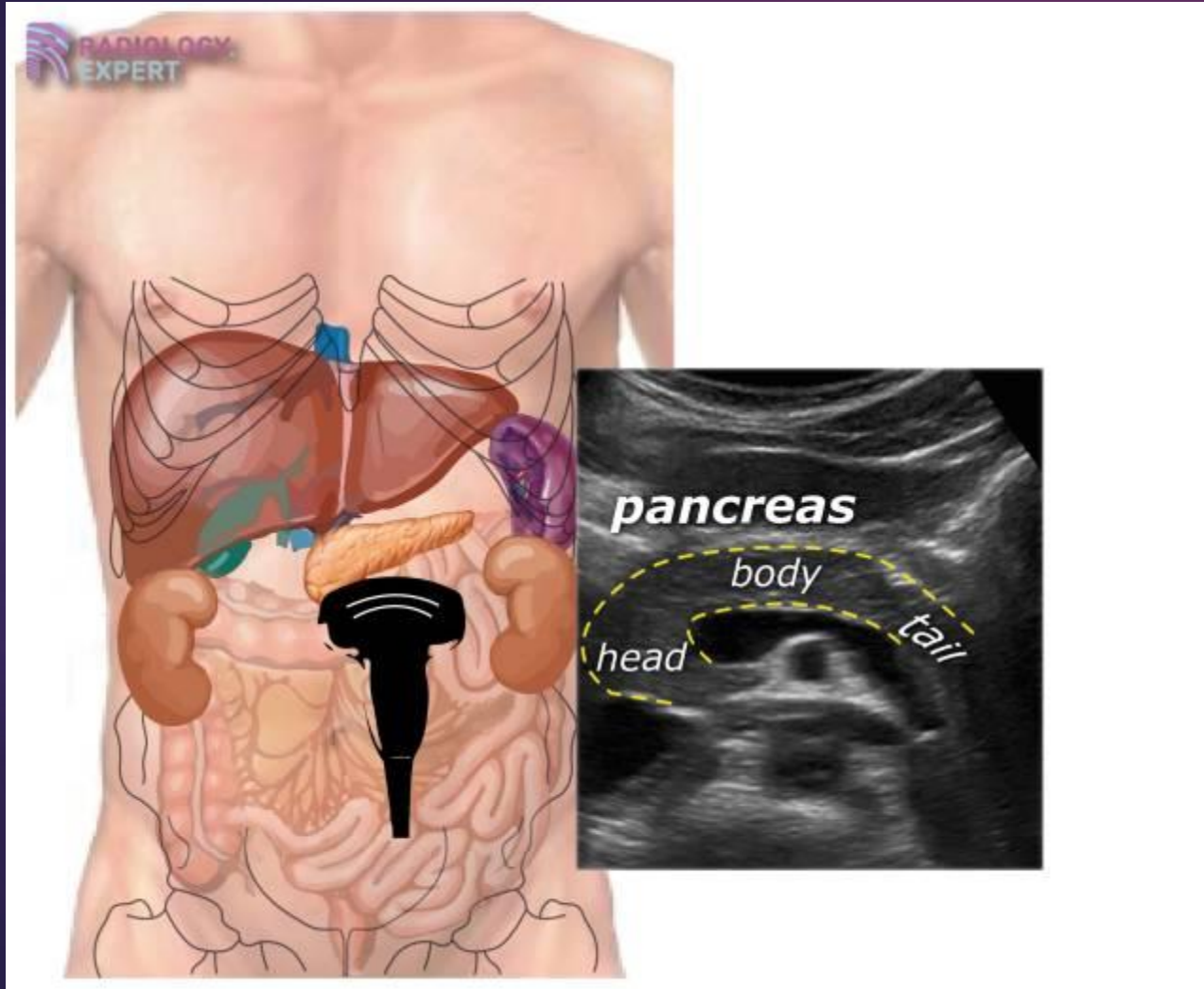
IVC

Pancreas

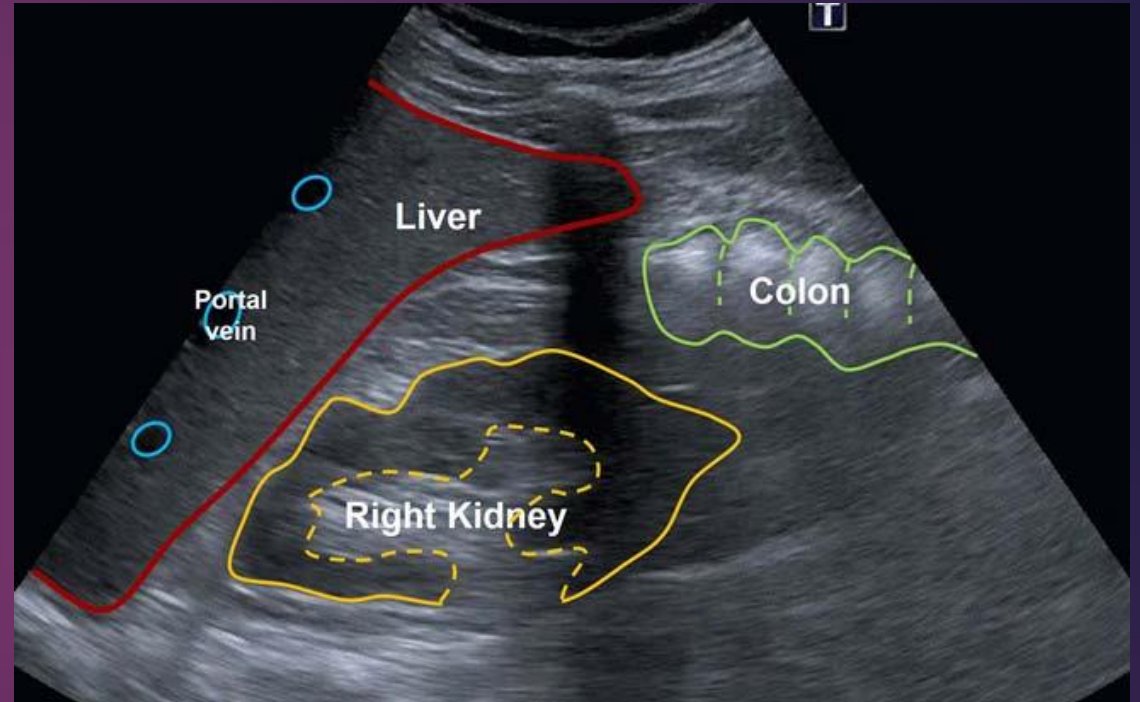
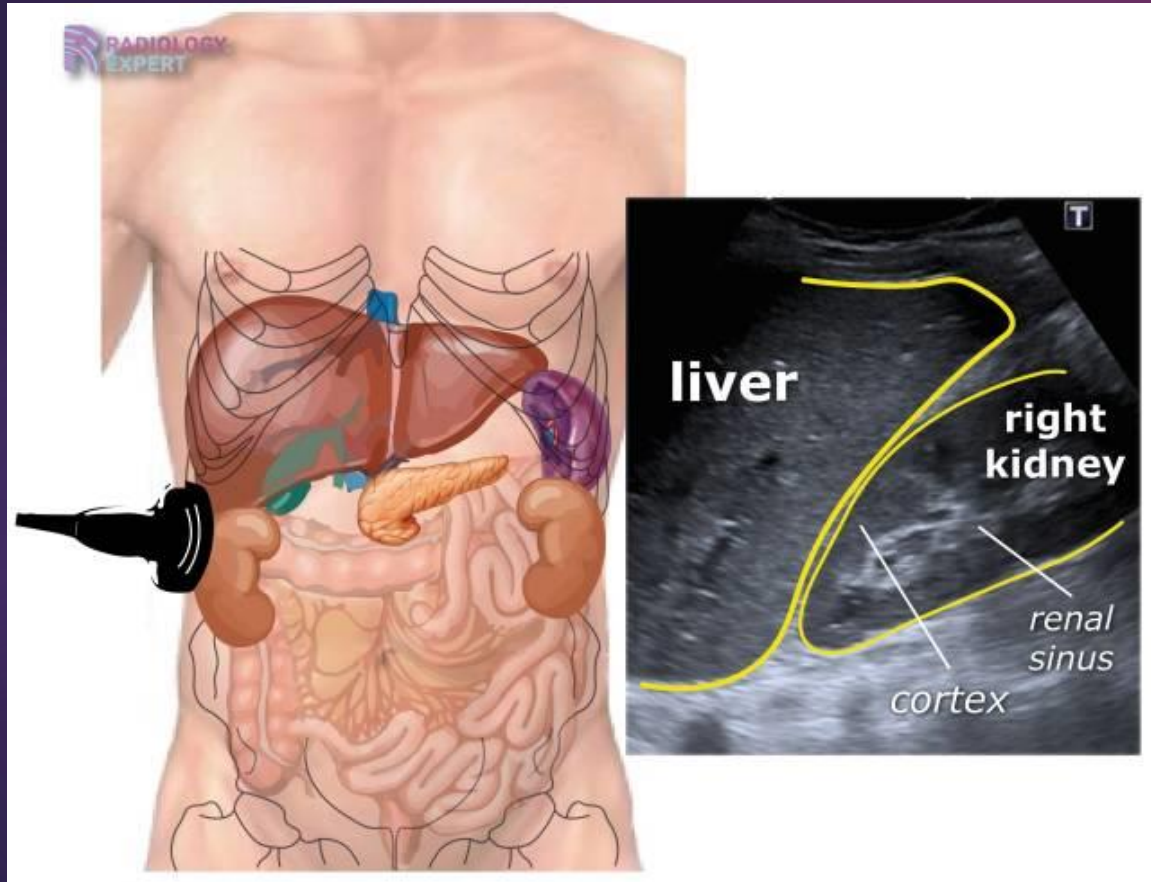
Left kidney

Left lobe of liver

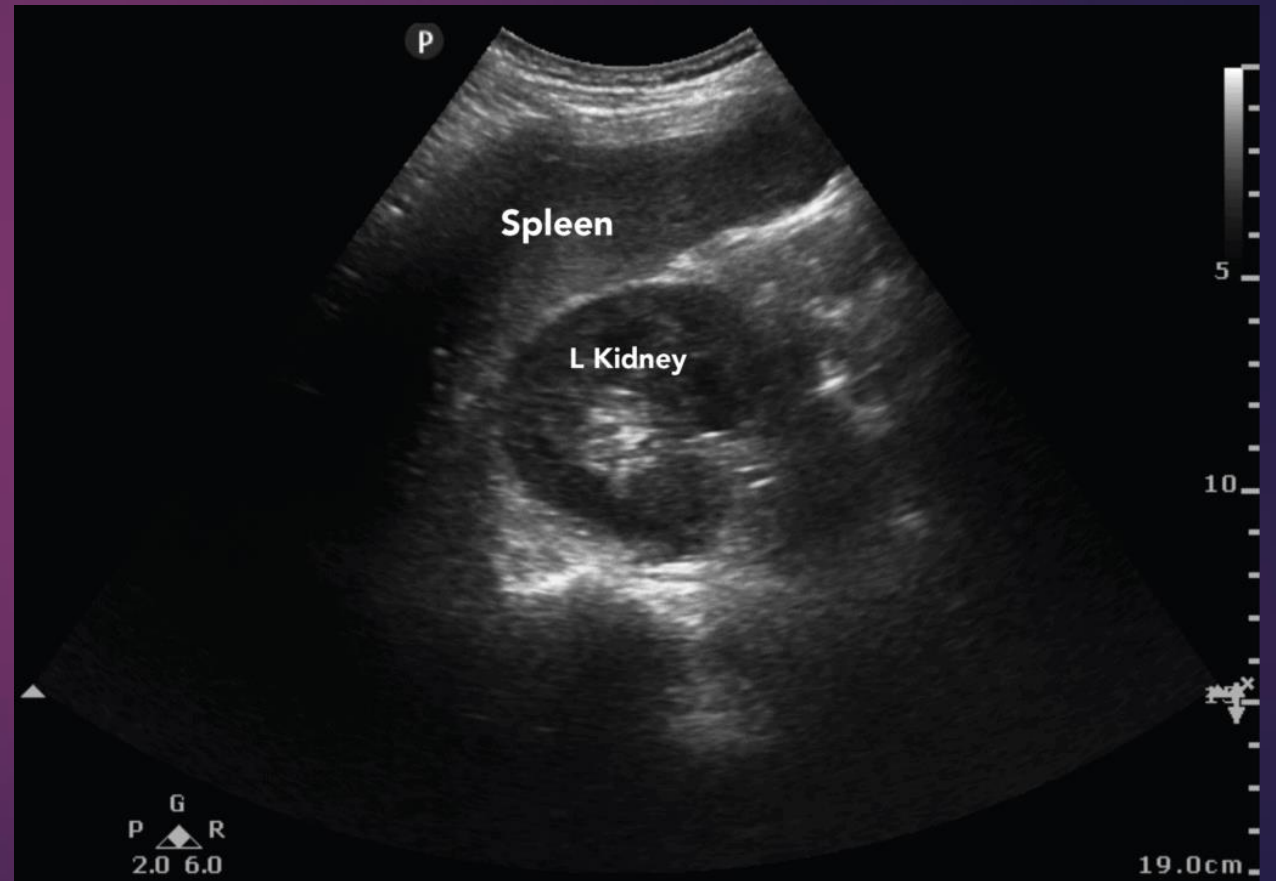
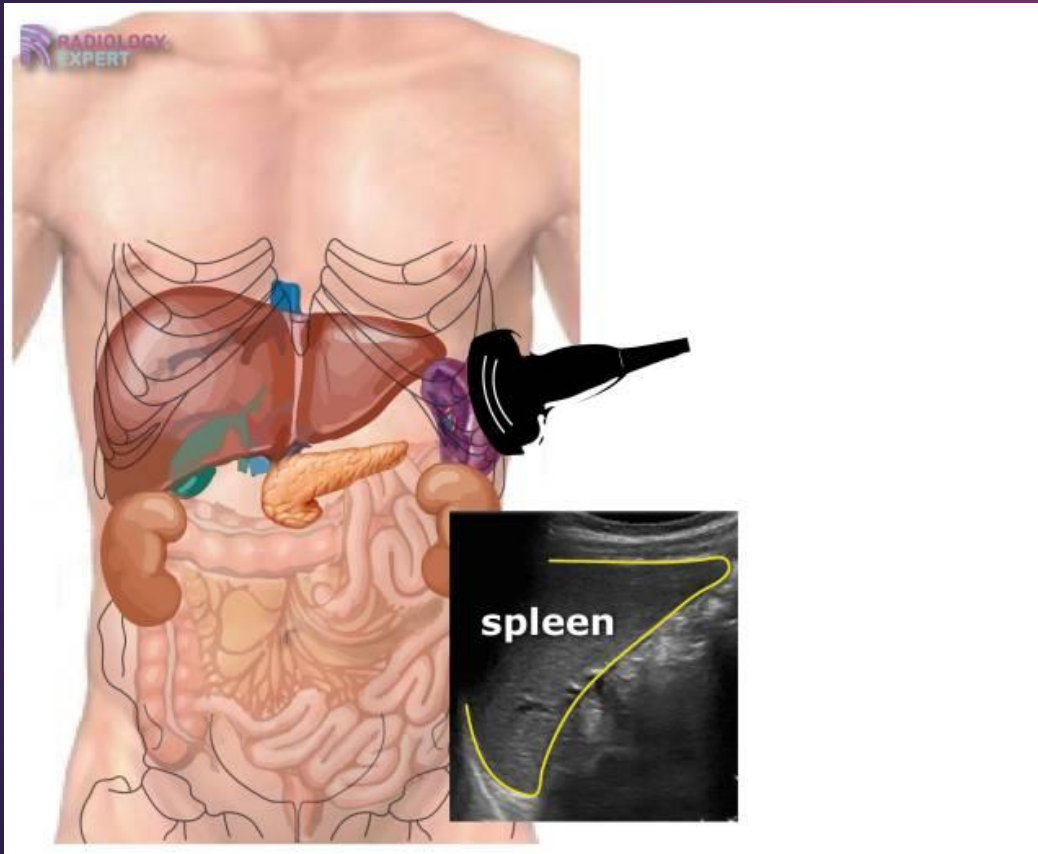
Pancreas



Right kidney



Spleen and left kidney



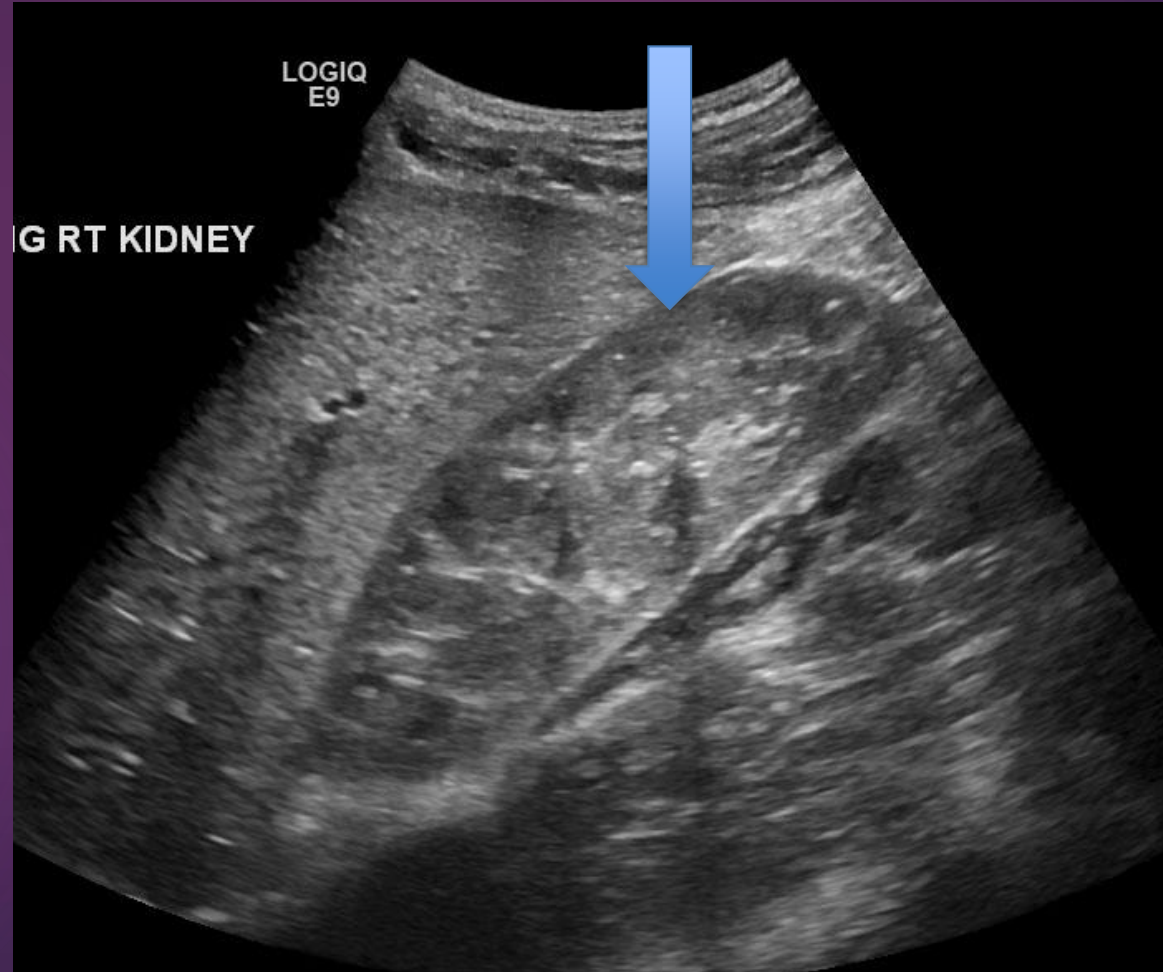
Aorta



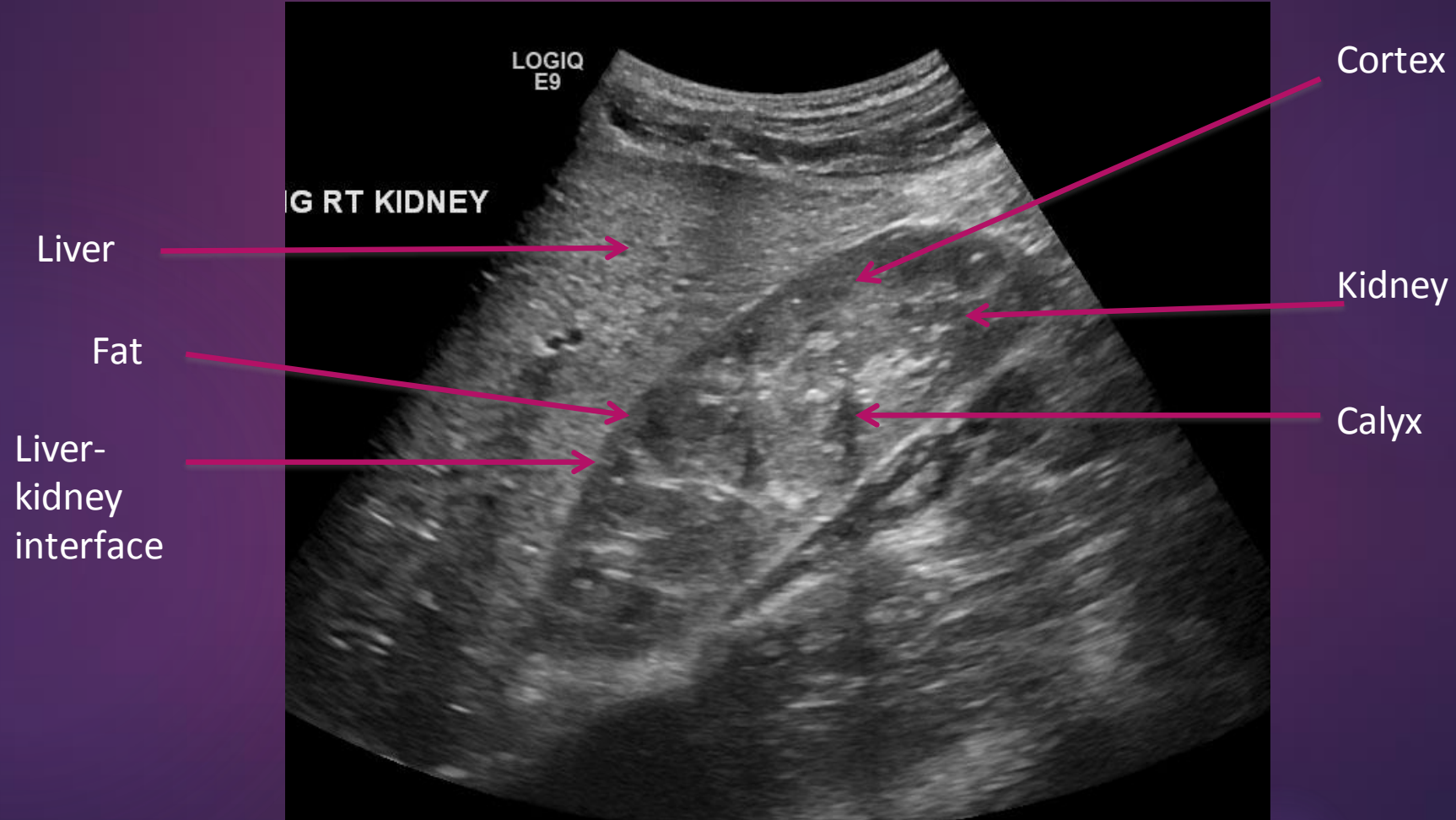
Indications

- ▶ Hernia
- ▶ Tumors/cancers/metastasis
- ▶ Ascites
- ▶ Organomegaly
- ▶ Free peritoneal fluid s/p trauma
- ▶ Gallbladder or kidney stones
- ▶ Evaluation of liver anatomy and ducts
- ▶ Pancreatitis
- ▶ Abscess
- ▶ Appendicitis
- ▶ Ultrasound guided biopsy

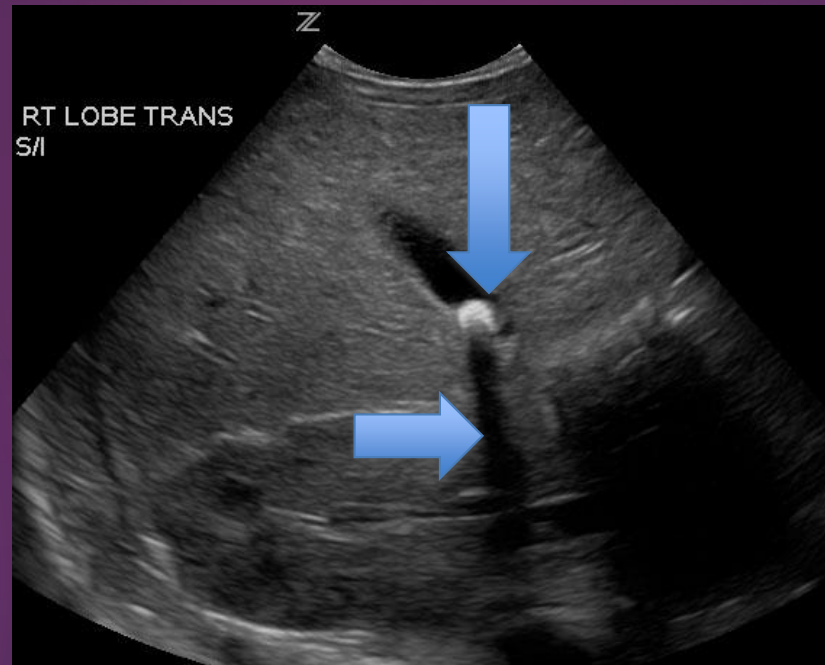
Kidneys – parenchyma hypoechoic to liver



Kidneys – parenchyma hypoechoic to liver



Gallstones – hyperechoic and shadowing underneath



Gallstones – hyperechoic and shadowing underneath

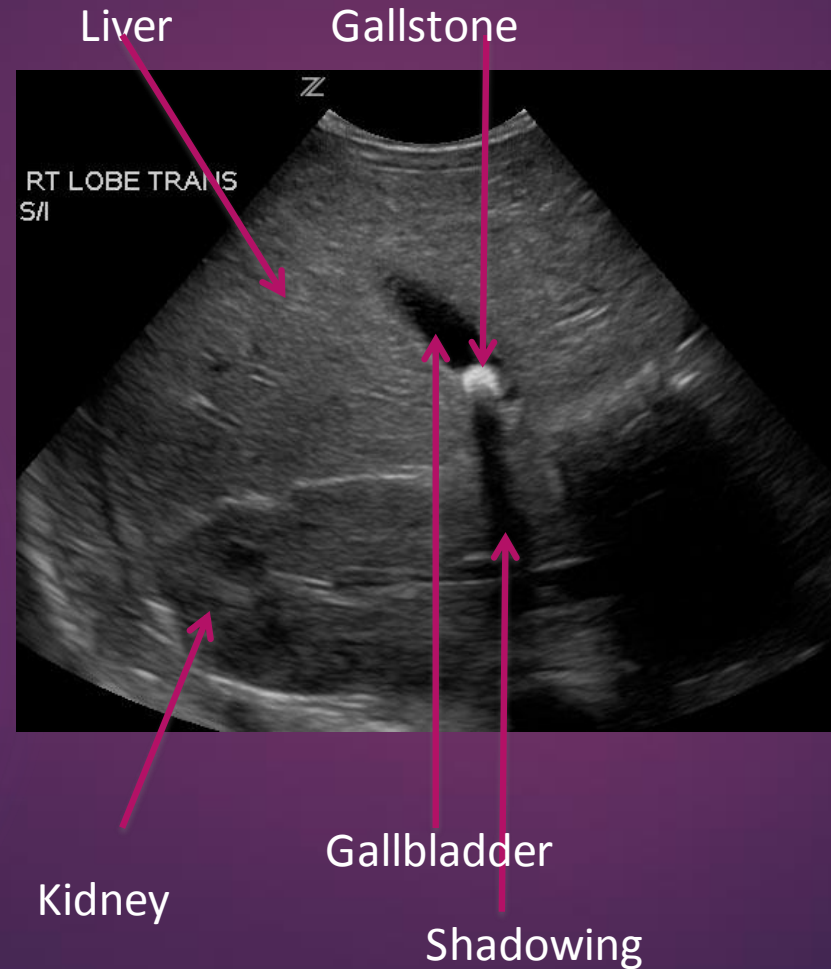


Image from UCMC

CT scan



CT abdomen

- ▶ **CT abdomen** is an increasingly common investigation that is used to help make diagnoses of a broad range of pathologies. A CT abdomen in its simplest form is a CT from diaphragm to symphysis pubis performed 60 seconds after pump-injection of iodinated contrast into a peripheral vein. However, depending on the clinical question, a variety of different protocols can be used.

❖ ADVANTAGES:

- Available
- Short scan time
- Much more soft tissue and bone details
- **Excellent** in diagnosing **extra-luminal lesions**
- **Excellent** in diagnosing the **cause** of bowel obstruction

❖ DISADVANTAGES:

- Radiation
- Some times need intra venous contrast (renal disease)
- Relatively expensive

❖ INDICATIONS

- abdominal pain
- abdominal sepsis
- bowel obstruction
- postoperative complications
- trauma
- vascular compromise, e.g. aortic aneurysm

Benefits:

- relatively quick and accessible
- reproducible findings
- complete assessment of the abdomen and pelvis

Limitations:

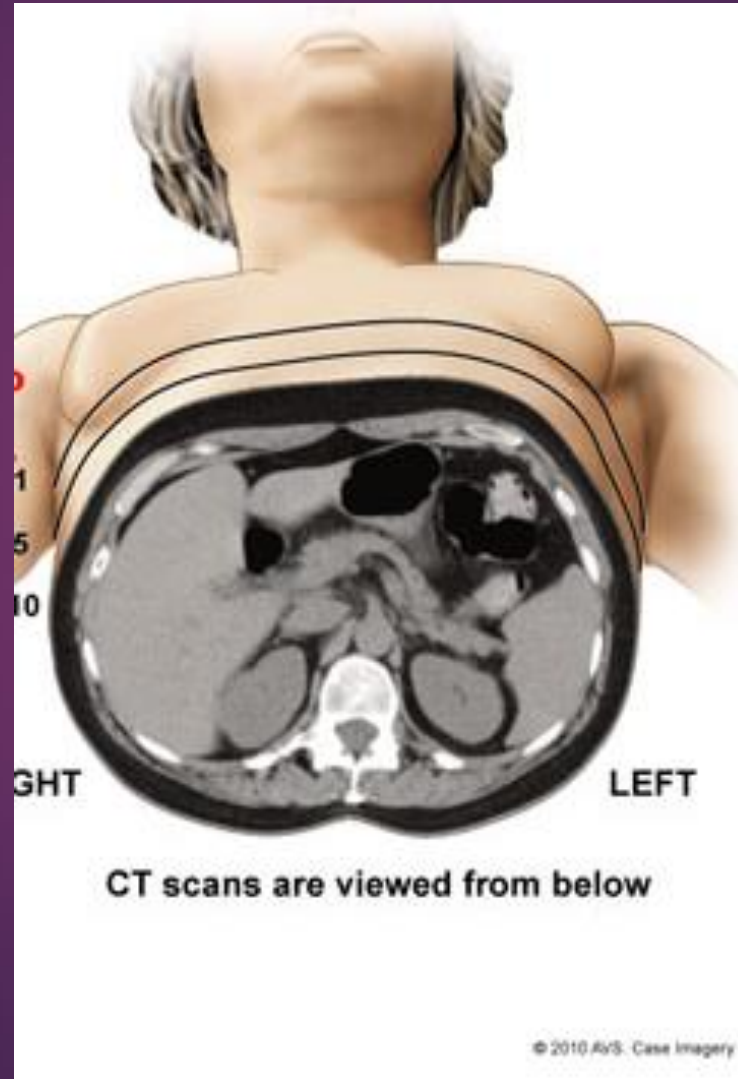
- uses ionizing radiation
 - risk of radiation-induced cancer
 - approximately 100 times the dose of a chest radiograph
- requires iodinated IV contrast
 - risk of renal impairment
 - risk of anaphylactic reaction

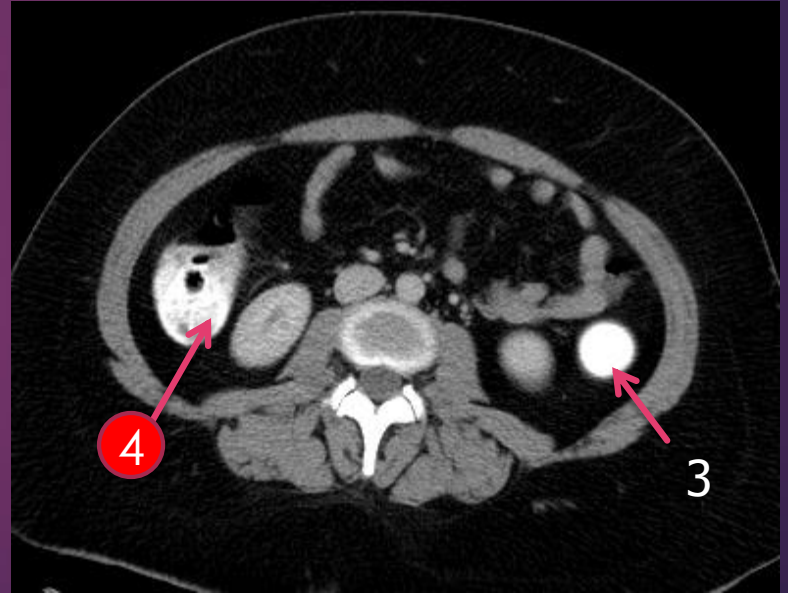
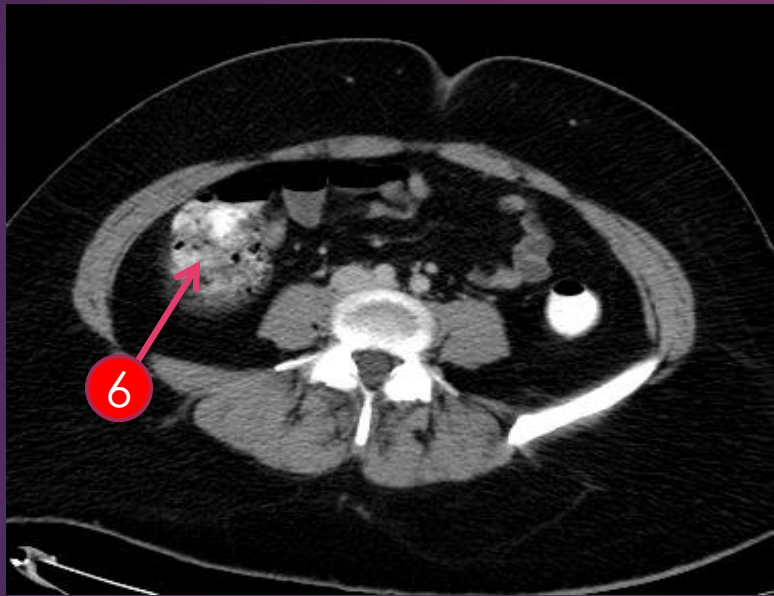
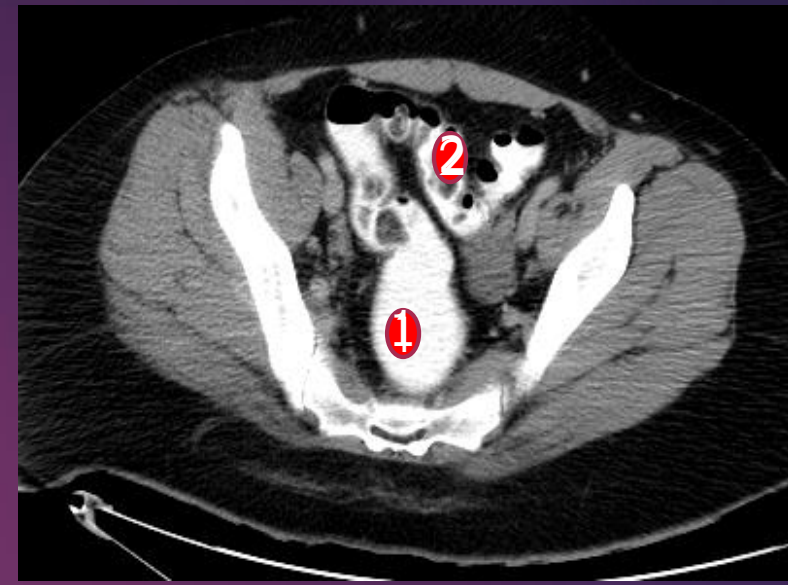
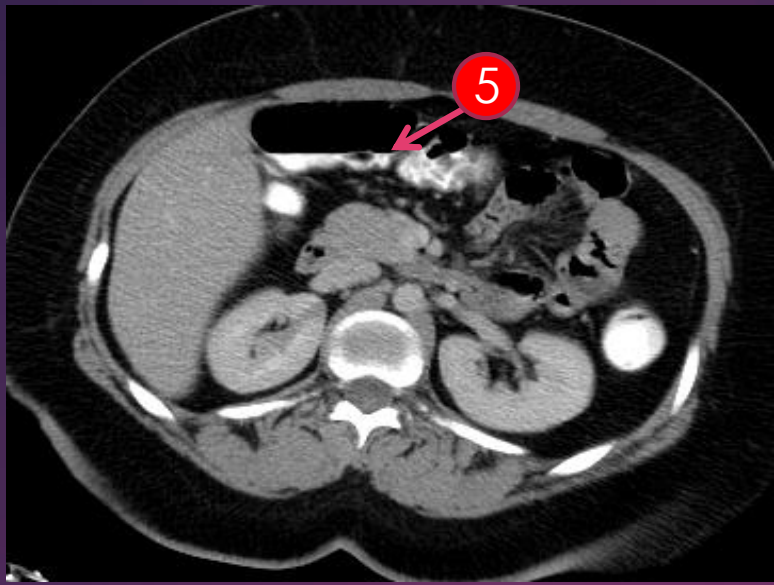
Important pathology:

bowel obstruction
bowel perforation
colon cancer
intra-abdominal trauma

Procedure

- ▶ check renal function
- ▶ lie patient supine on CT table
- ▶ scout image to plan study
- ▶ IV contrast injected via pump-injector
- ▶ 60-second delay
- ▶ scan from dome of diaphragms to symphysis pubis





1- Rectum

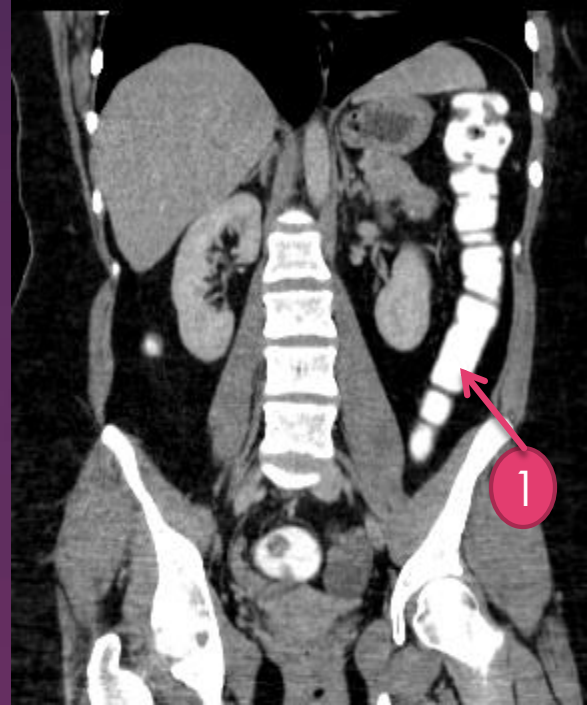
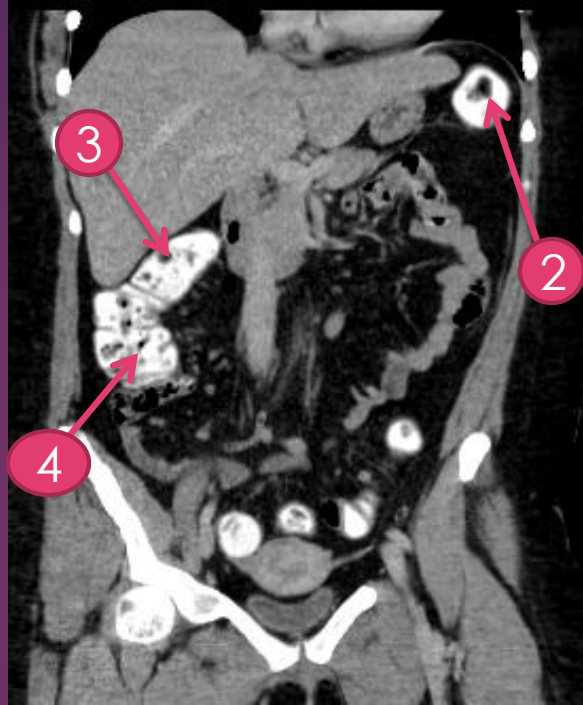
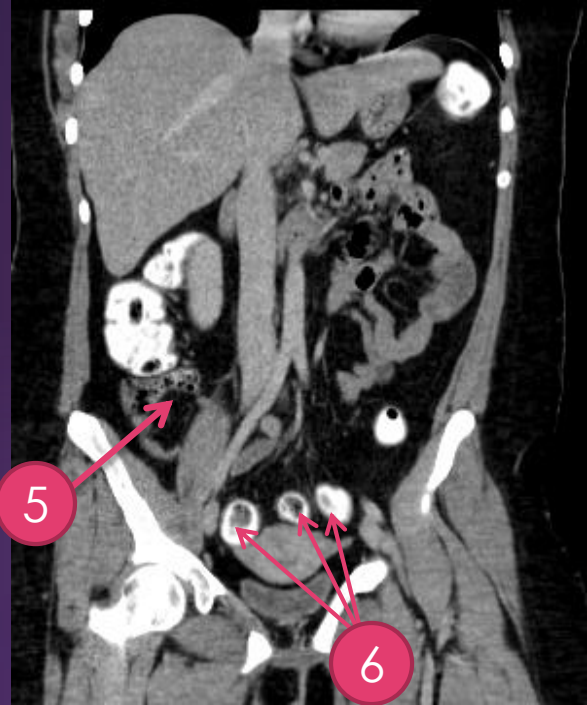
2-Sigmoid colon

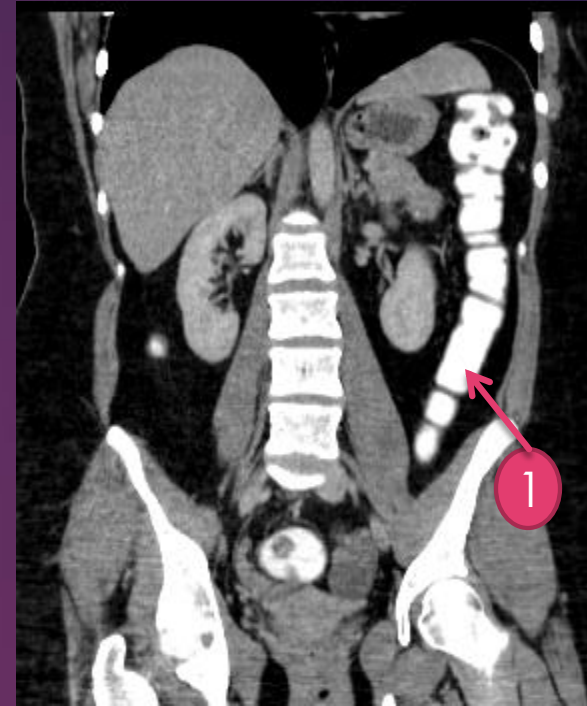
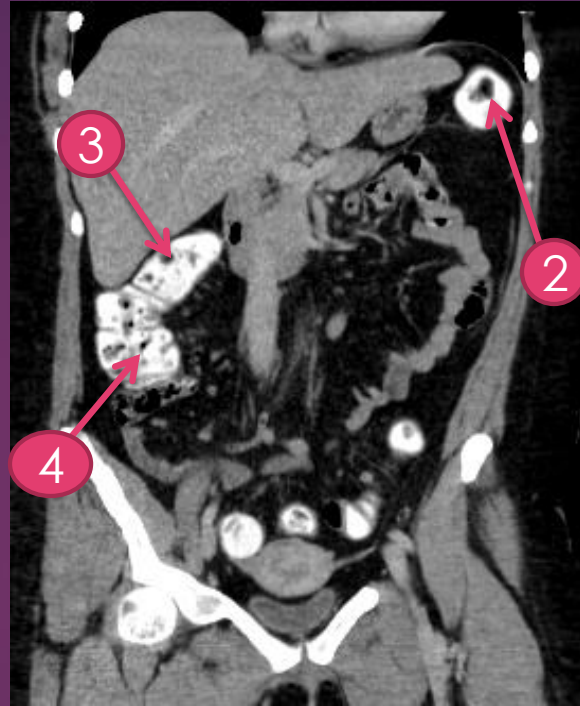
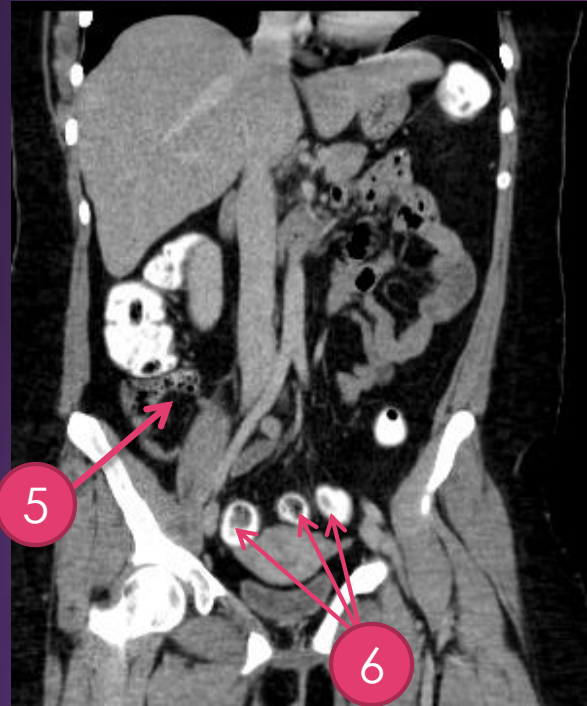
3-Descending colon

4-Ascending colon

5-Transverse colon

6-Cecum



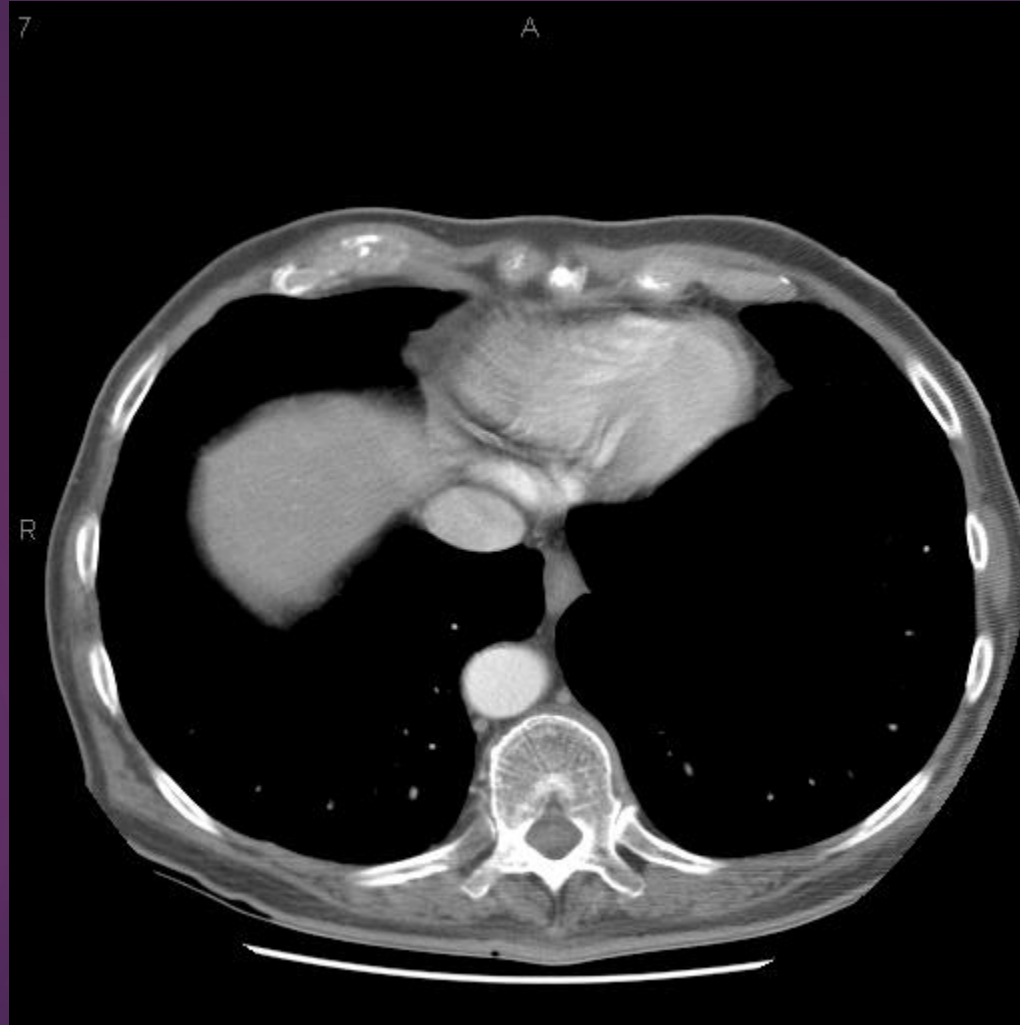


1. Descending colon
2. Splenic flexure
3. Hepatic flexure
4. Ascending colon
5. cecum
6. Sigmoid colon





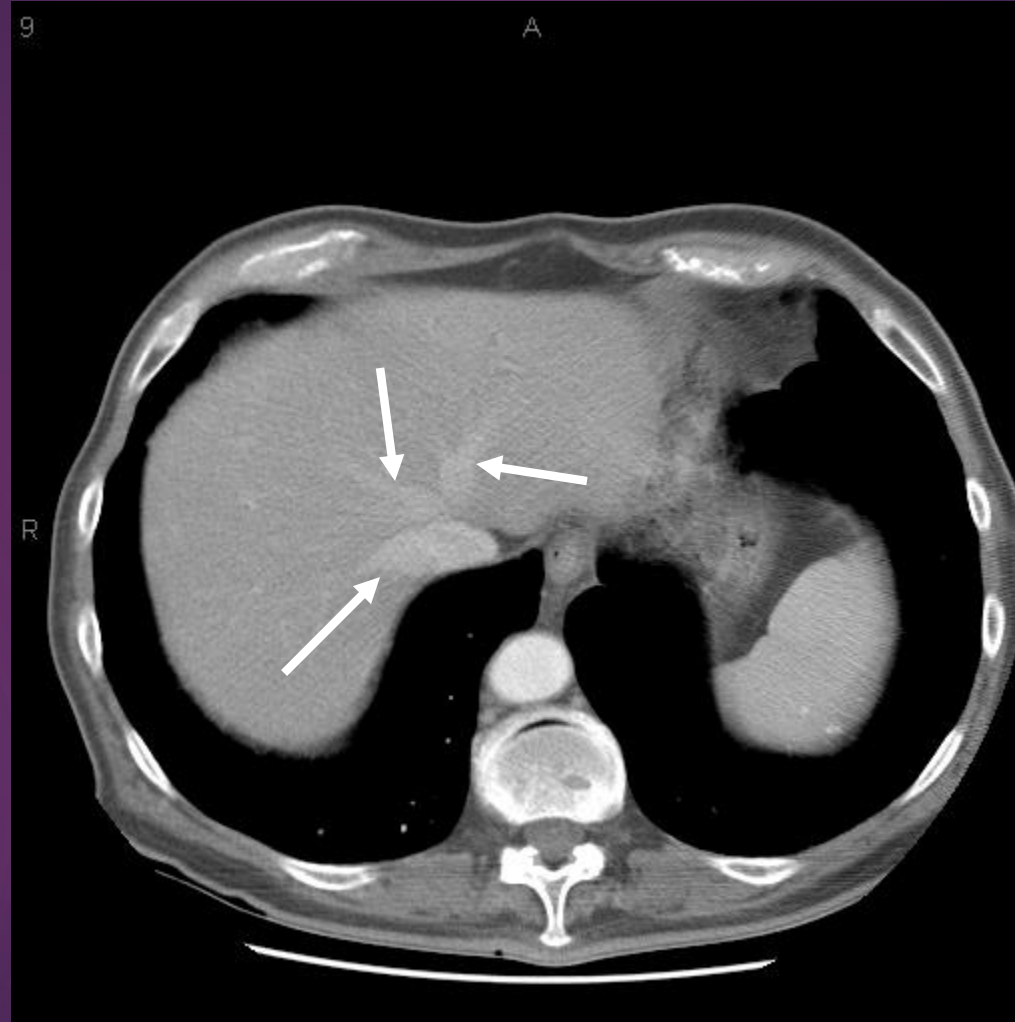






**What is this
contrast
containing
structure
posterior to the
liver?**

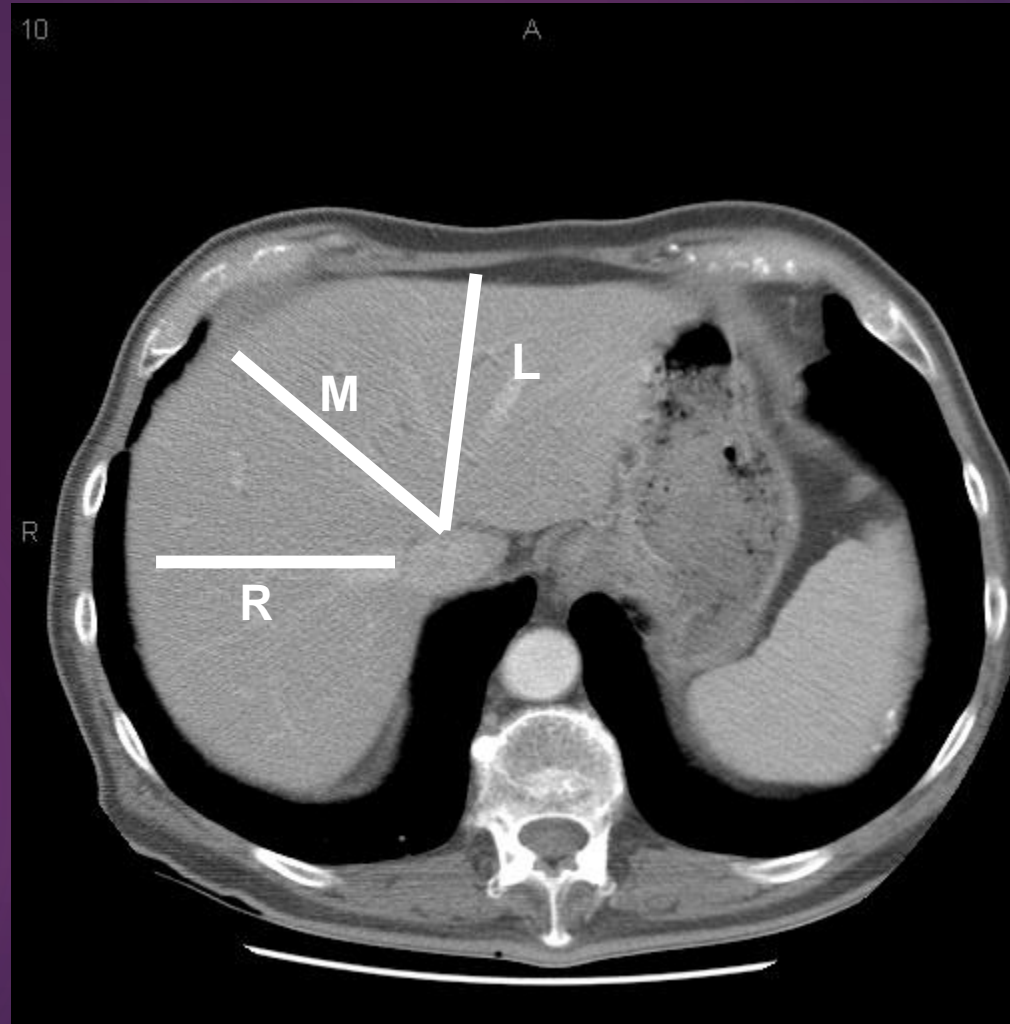
IVC



**What are these
contrast containing
structures dumping
into the IVC**

**The right,
middle and
left hepatic
veins**

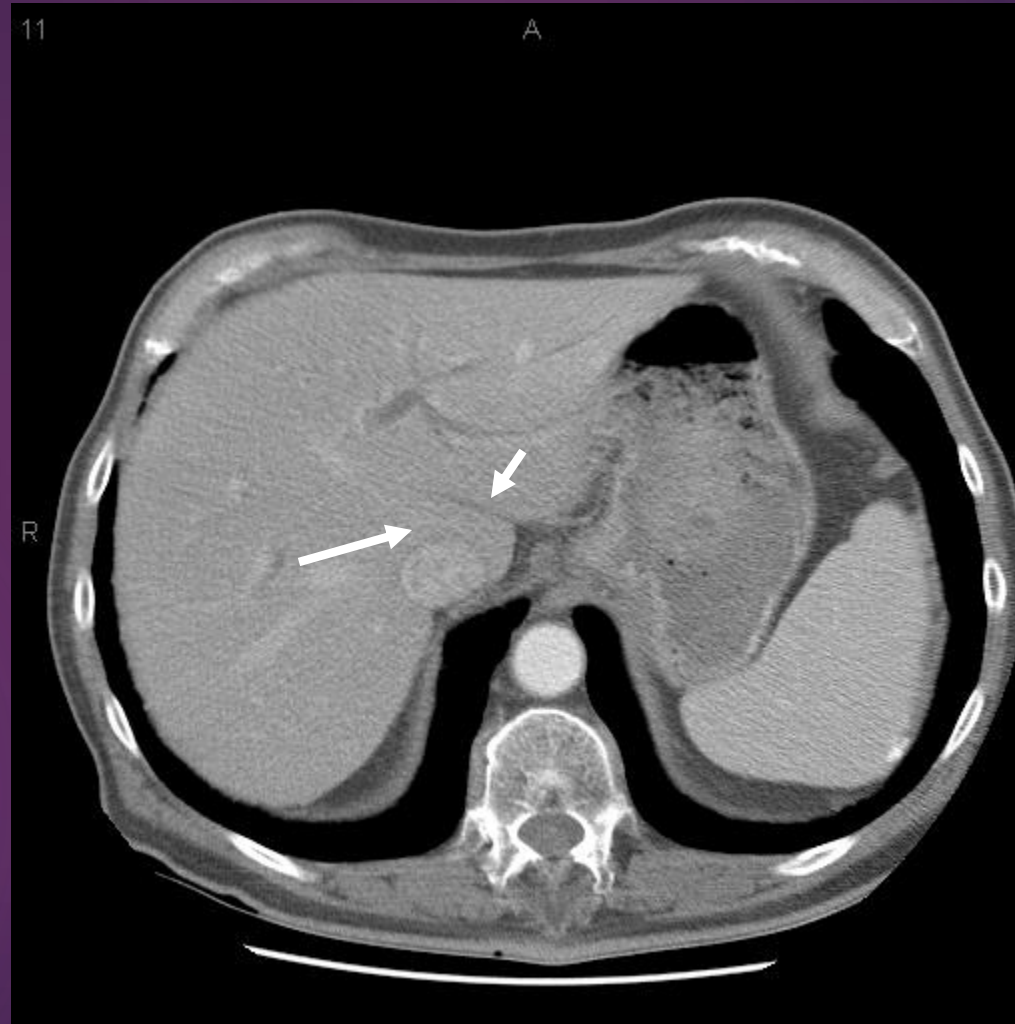
What anatomically divides the liver into lobes (right and left) and segments.



The hepatic veins. Middle hepatic vein divides the right and left lobes. The right hepatic vein splits the right lobe into anterior and posterior segments. The left hepatic vein divides the left lobe into medial and lateral segments.

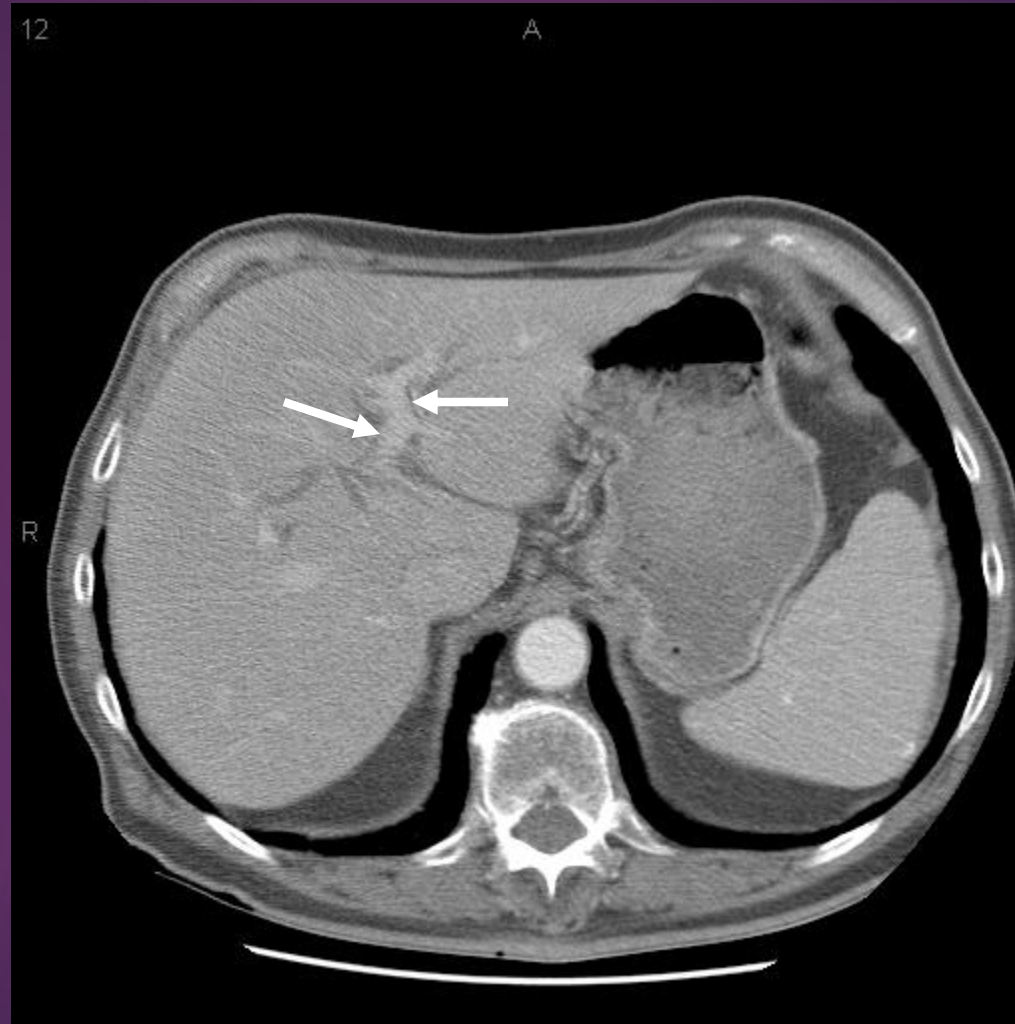
What lobe of the liver is marked with the arrow

The caudate lobe



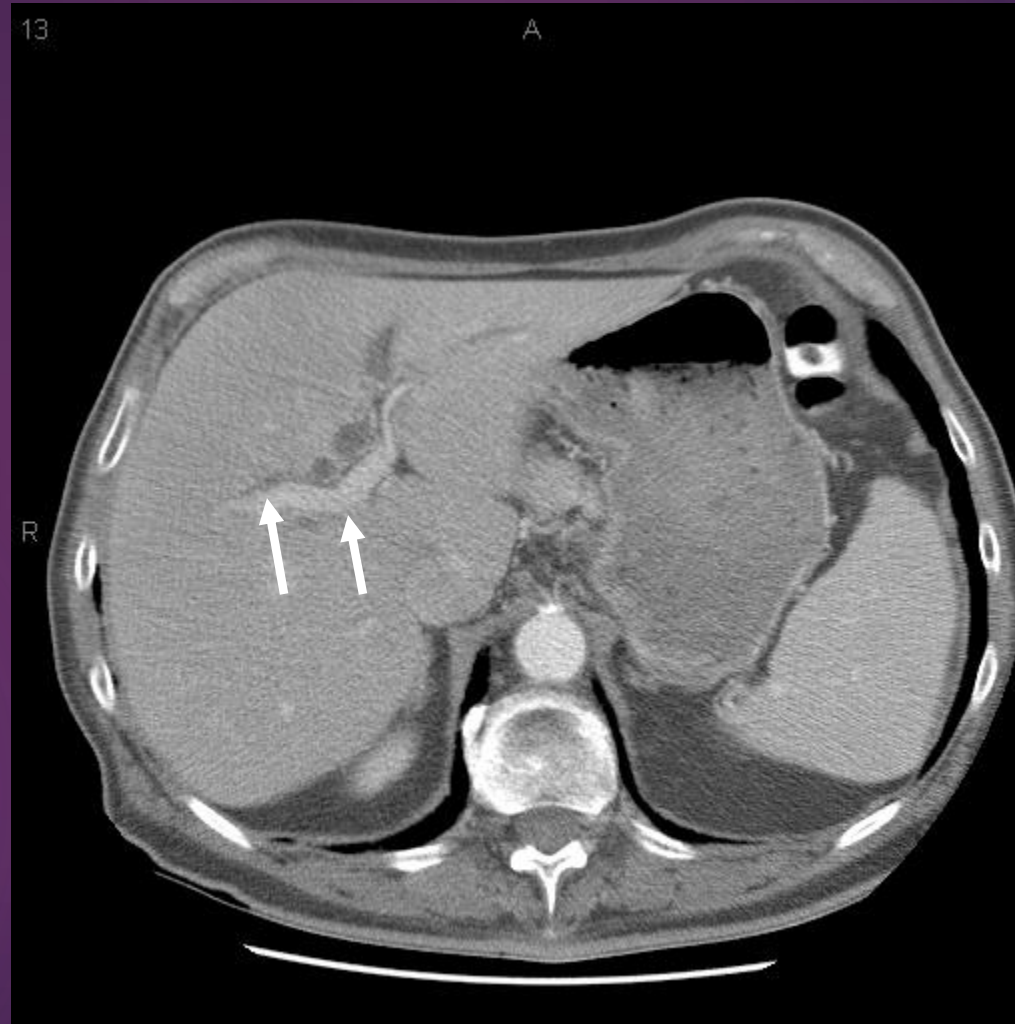
Can you identify the
bright structure
surrounded by the
black arrows?

This is the left portal
vein



Can you identify the
bright structure
marked by the black
arrows?

This is the right
portal vein



Can you identify the low attenuating structure marked by the black arrows

This is the common hepatic duct

What are the branches of the celiac trunk

Common hepatic, splenic and left gastric

What branch of the aorta is marked

This is the celiac trunk



This is a sagittal image from a CT angiogram. Can you identify the vessels coming off of the aorta?

Solid arrow--celiac trunk.

Dotted arrow--SMA



This is a CT angiogram of the abdominal vessels.

Can you pick out the celiac trunk?

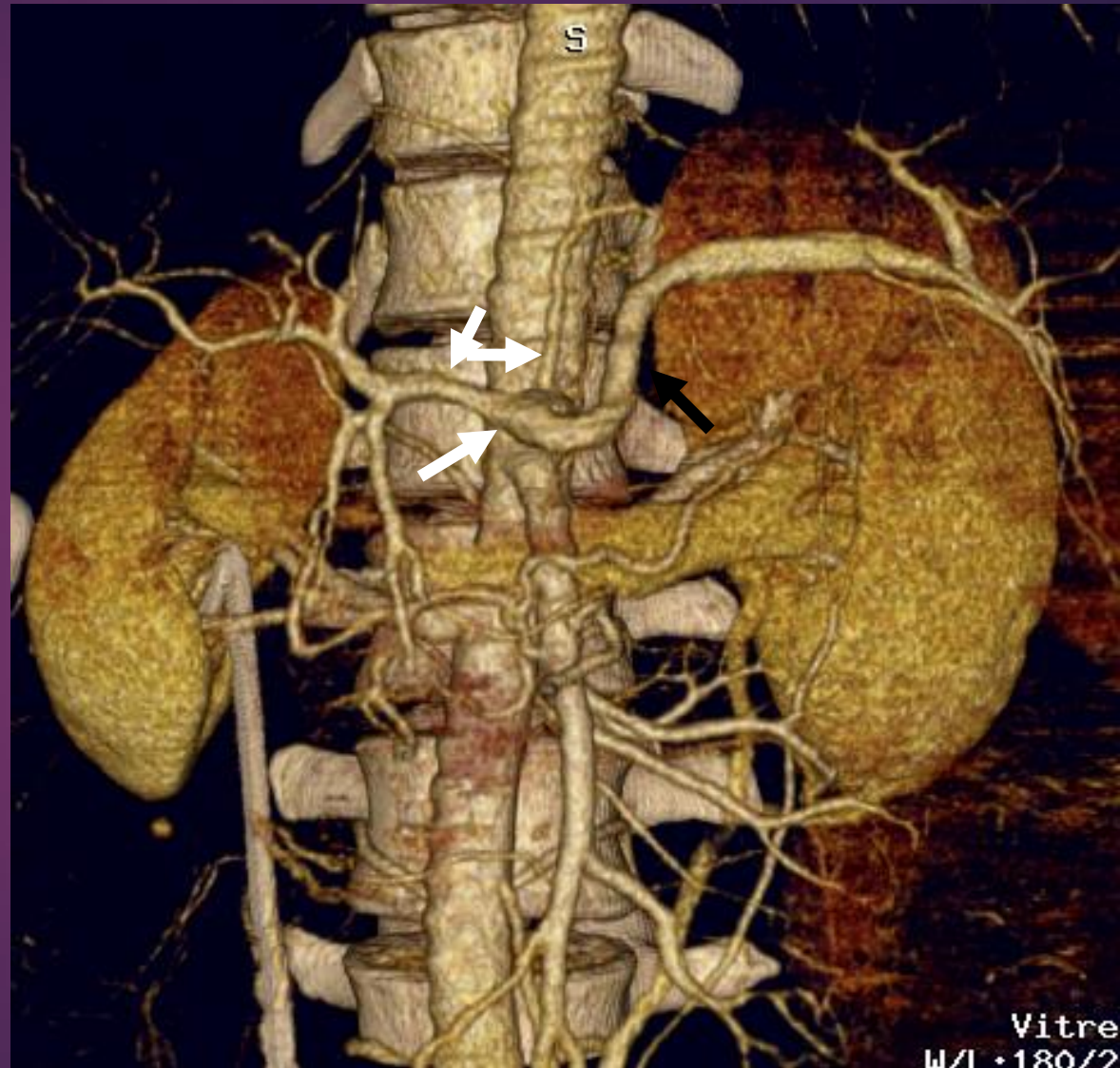
Can you see the 3 branches: common hepatic, splenic and left gastric?

Celiac trunk

Splenic artery

Common hepatic

Left gastric



These are 2 sequential coronal images from a CT angiogram showing the pancreatic blood supply.

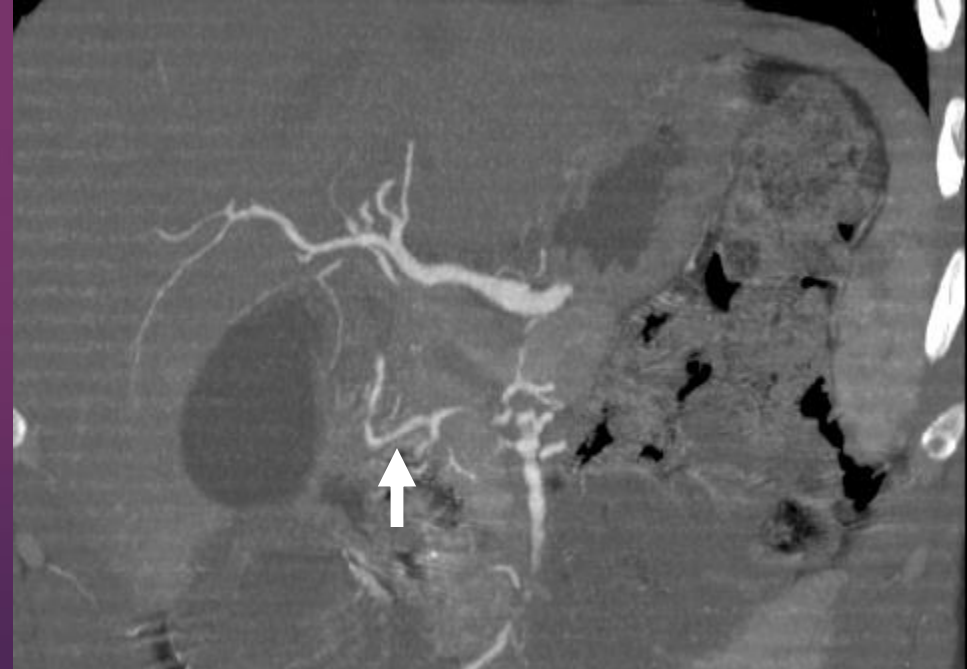
This is the common hepatic artery off the celiac trunk.

What branch is this extending inferiorly?

Gastrooduodenal artery

This artery is anastomosing with which artery coming off the SMA?

Inferior pancreaticoduodenal



What is this fluid
and air filled
structure
between the liver
and spleen?

This is the stomach



What portion of colon do you see anterior to the spleen and next to the stomach?

What part of the pancreas is this?

What part of the pancreas is this?

This is the splenic flexure.



The body

This is the tail and it usually extends further over towards the spleen.

What is this low attenuation structure (black arrows) adjacent to the pancreas (white arrows)

What is this vein just behind the pancreas?

What venous structure does this join to make up the portal vein?

What are the tiny metallic structures anterior to the common bile duct

Common bile duct

Splenic vein

The splenic vein joins the superior mesenteric vein to make up the portal vein

These are clips from a cholecystectomy



Hint: does this person have a gallbladder?

What is the structures anterior and near the superior aspects of the left kidney?

This is the left adrenal gland



This is an MRI cholangiogram

**Can you find the dilated
common bile duct?**

**Do you see the more
normal appearing
pancreatic duct?**



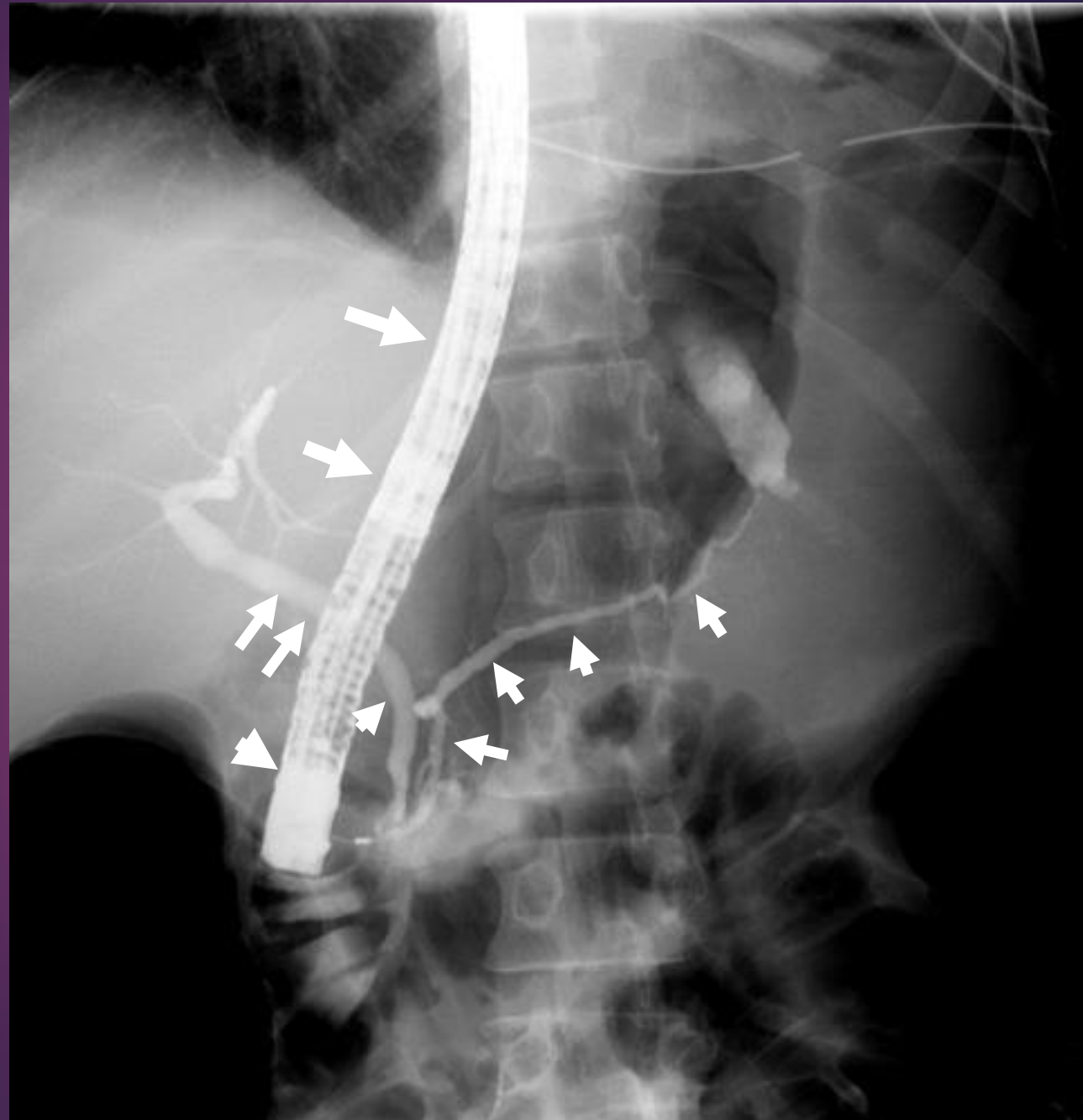
**This is an ERCP on a different patient.
Can you find the
common bile duct?**

**ERCP=endoscopic
retrograde
cholangio-
pancreaticogram.**

**Can you find the
pancreatic duct?**

**What is this
large structure?**

**This is the
endoscope use to
inject the contrast
in the common
bile duct and the
pancreatic duct
for the ERCP.**



Do you see the
SMV on this image?

Hard question



What part of the pancreas are these arrows defining?

Hint, it is the most inferior portion of the pancreas

What is this small pointed area medial to the head of the pancreas.

What is this high attenuating structure (artery) just anterior to the uncinate process?

This is the pancreatic head



This is the uncinate process

Superior mesenteric artery (SMA)

**What is this
low attenuation
structure in the
pancreatic
head?**



**This is the
intrapancreatic
portion of the
common bile
duct**

**What is this tiny low
attenuating structure in
the pancreas?**

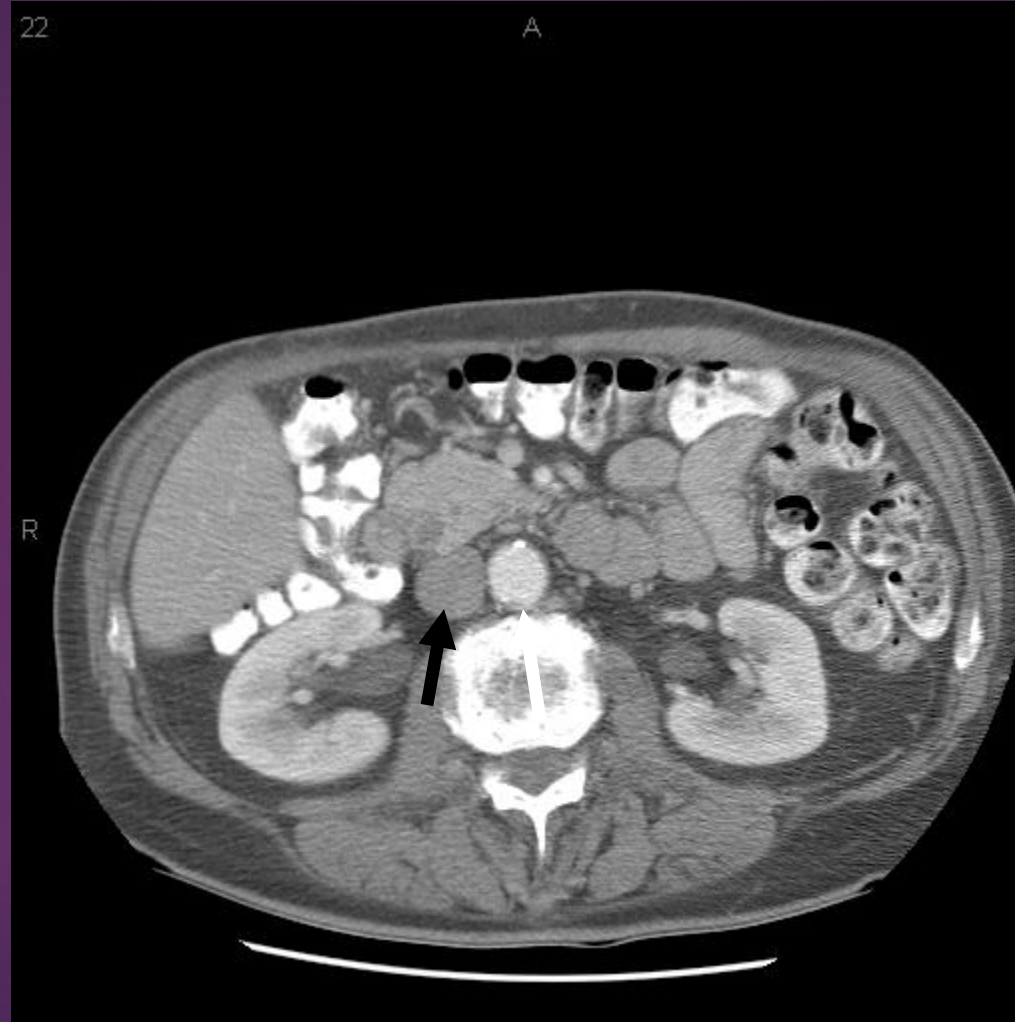
Pancreatic duct

**What are these 2
vascular
structures?**

**IVC (white arrow)
Aorta (black arrow)**

**Why is the aorta
filled with
contrast and the
IVC is not?**

**Hint, do we give
our injections in
the artery or
vein? And do we
inject in the
upper or lower
extremity?**



**We inject
intravenously
in the upper
extremity (arm),
so the blood
goes to the
SVC to heart to
arterial system
then to lower
extremity
venous system.**

**Do you see this
patient's tumor?**

**It is very subtle, it
is right where the
CBD enters the
duodenum at the
ampulla.**



**If you picked
up that tumor,
you have a
promising
career in
radiology!!**

What part of the colon is this? It is anterior on a long mesentery.

This is the transverse colon



25

A



26

A

R



27

A

R



MRI



❖ ADVANTAGES:

- Relatively safe in pregnancy (no radiation)
- Give much more soft tissue details
- Excellent in diagnosing abdominal solid organ lesion: liver, spleen, kidneys

❖ DISADVANTAGES:

- Expensive
- Long scanning time
- Sensitive to motion

❖ INDICATIONS

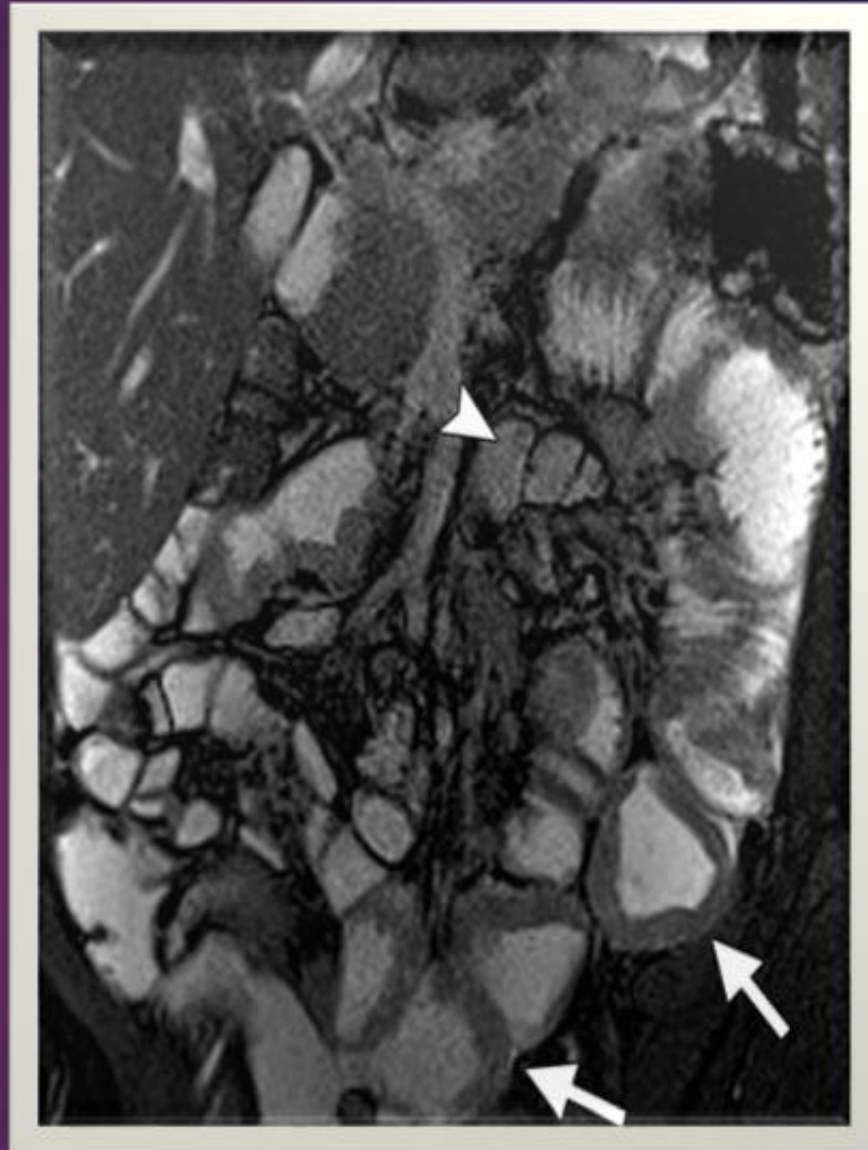
- Abdominal **solid** organ masses
- Inflammatory bowel disease

❖ CONTRAINDICATIONS:

- uncooperative patients
- Early pregnancy (relative contraindication)
- No IV contrast renal failure (relative contraindication)
- Pacemaker or metallic prosthesis

Inflammatory bowel disease

- Bowel wall thickening



Thank you!