

# RADIOLOGY OF ABDOMEN

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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.

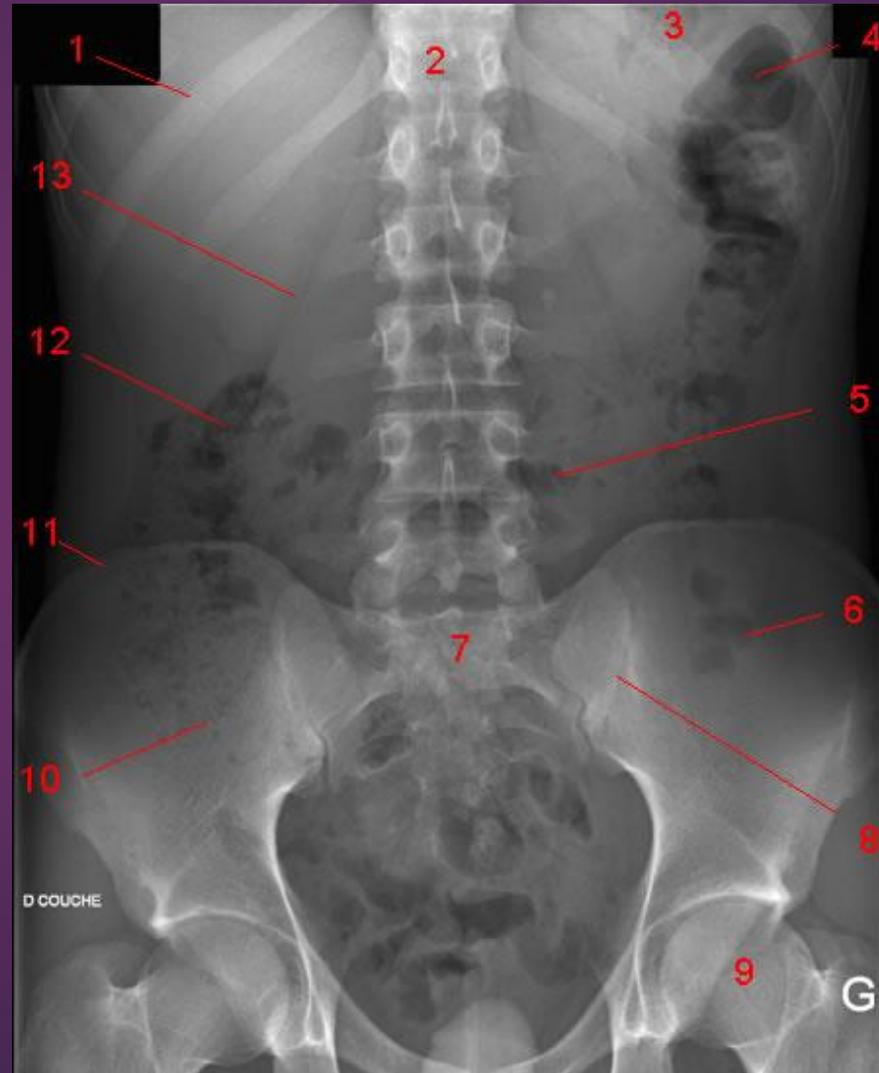
## ❖ ADVANTAGES:

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

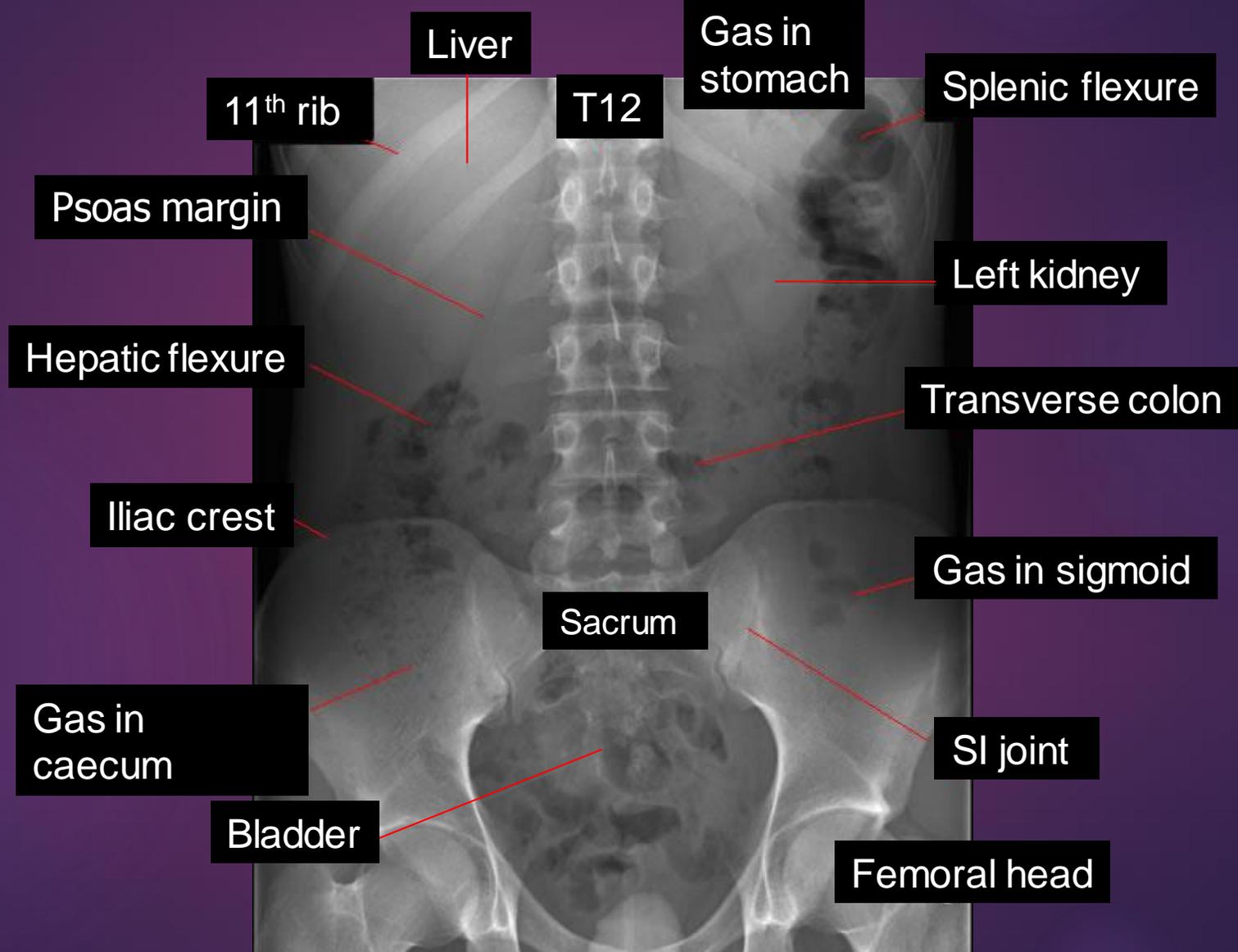
## ❖ DISADVANTAGES:

- Radiation
- Poor soft tissue details

# Normal AXR



# Normal AXR



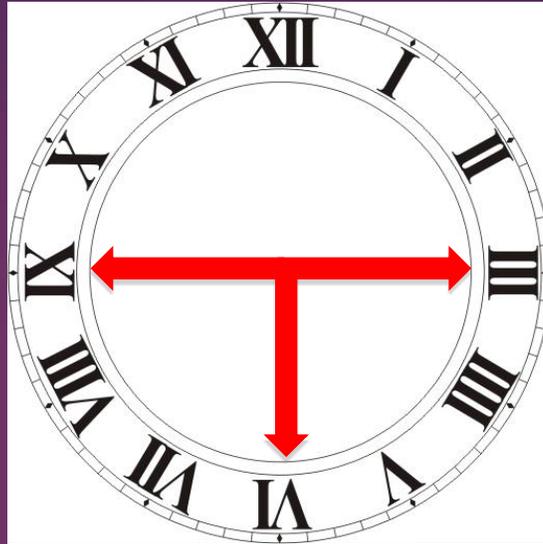
First step of reading an Abdominal X-ray is assessing **gas pattern**

## 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

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

# Abnormal contour of gas-containing loops

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

# Extraluminal gas

<b>Causes</b>	<b>Radiological features</b>
<b>Intraperitoneal Perforation of a hollow viscus</b>	<b>Variable amounts of gas, from small crescent under diaphragm (erect film) to gross peritoneal distension</b>
<b>Subphrenic abscess</b>	<b>Air-fluid level under diaphragm. Adjacent lung base consolidation. Confirm with ultrasound</b>
<b>Bowel wall Infarction, necrotising enterocolitis in infants</b>	<b>Linear streaks of gas in bowel wall. May coalesce or outline portal vein radicles</b>
<b>Pneumatosis coli</b>	<b>Blebs of gas in colon wall. Symptoms may mimic carcinoma. Usually elderly patient with airways obstruction</b>
<b>Biliary tree After sphincterotomy or anastomosis between biliary tree and bowel</b>	<b>Branching gas pattern in liver (bile ducts). Usually lie centrally in liver; gas in portal vein radicles extends more peripherally</b>
<b>Erosion of gallstone into small bowel; erosion of duodenal ulcer into biliary tree; pancreatic neoplasm; gas-forming infection</b>	<b>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</b>
<b>Genitourinary tract Fistula, e.g. trauma, postoperative, Crohn's disease</b>	<b>Gas may outline urinary bladder, ureters and collecting systems. Differential diagnosis: gas-forming infection in diabetic patients</b>

# 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

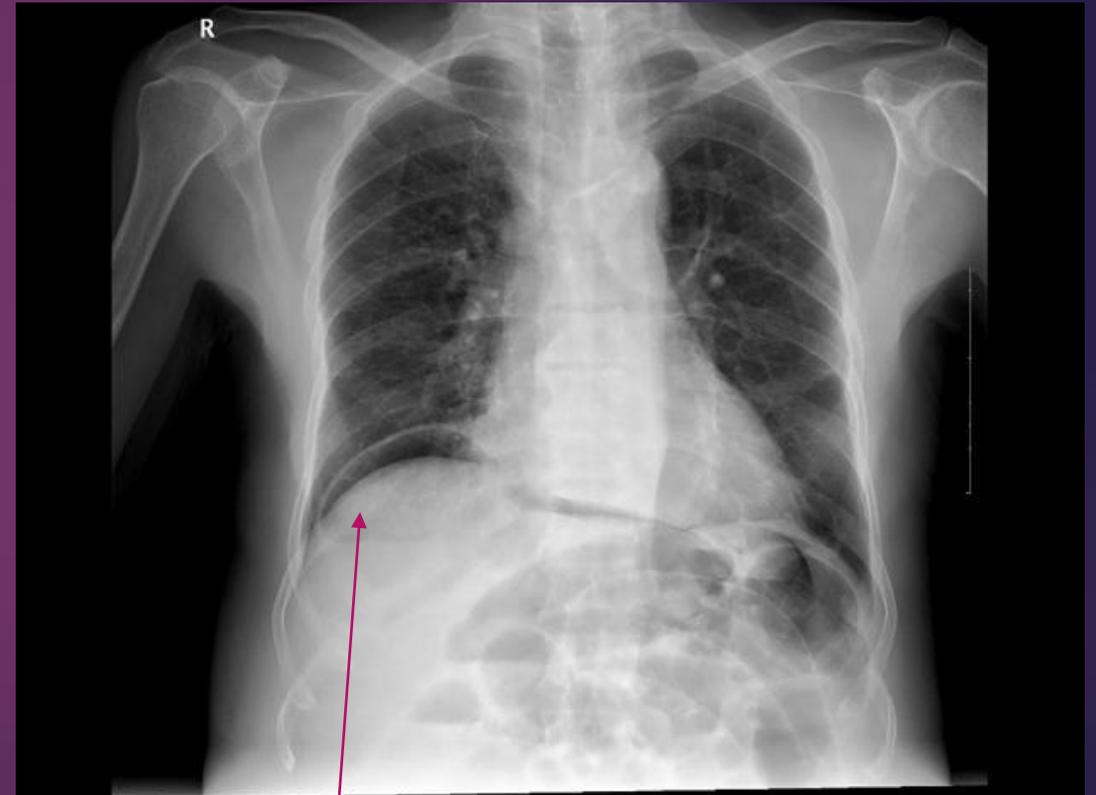
# Pneumoperitoneum

**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

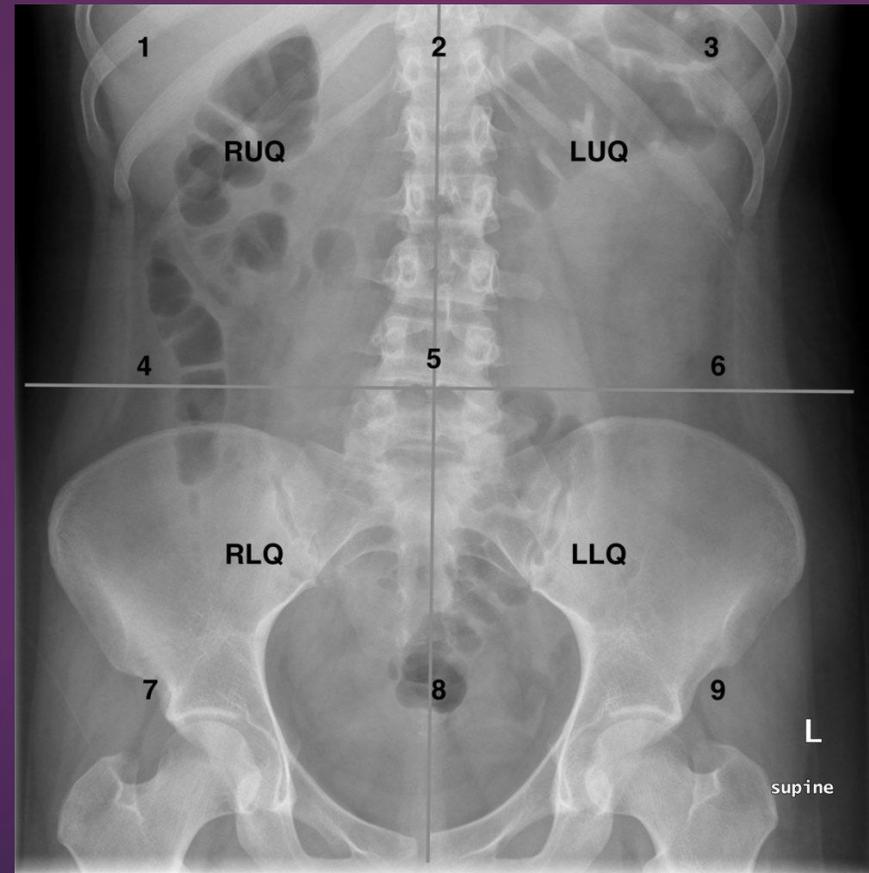
- ▶ Some degree of ileus is a normal and expected finding after abdominal surgery, including C-section<sup>9</sup>. Conventional recovery times have been reported at<sup>4</sup>:
  - ▶ small intestine: 0-24 hours
  - ▶ stomach: 24-48 hours
  - ▶ colon: 48-72 hours
- ▶ These intervals, however, may be overestimations<sup>5</sup>.
- ▶ 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

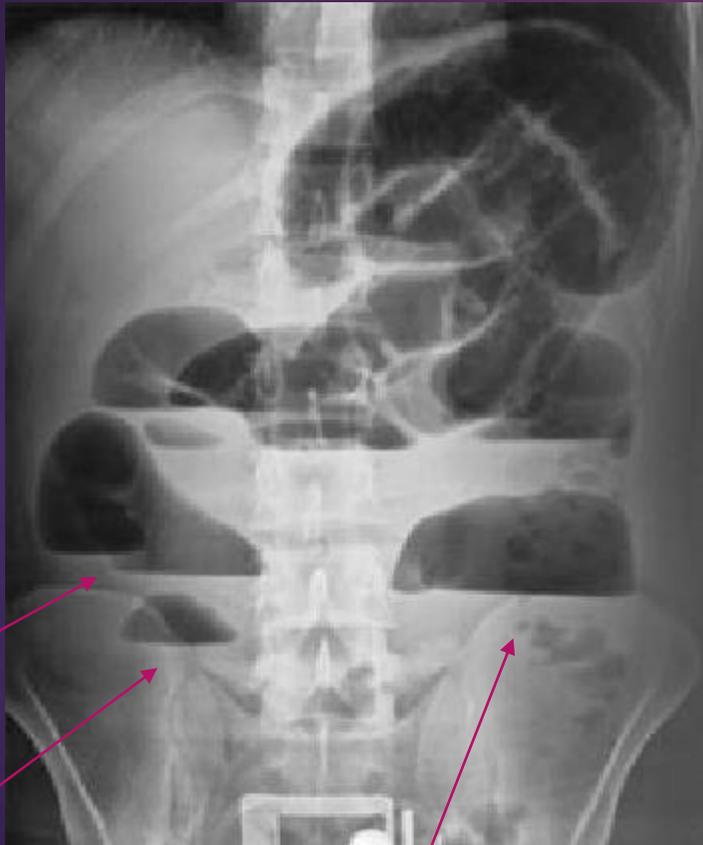
- ▶ generalized, uniform, gaseous distension of the large and small bowel
  - ▶ involvement of large bowel and lack of a transition point help distinguish it from small bowel obstruction
- ▶ when localized, there may be a sentinel loop
- ▶ Air fluid levels



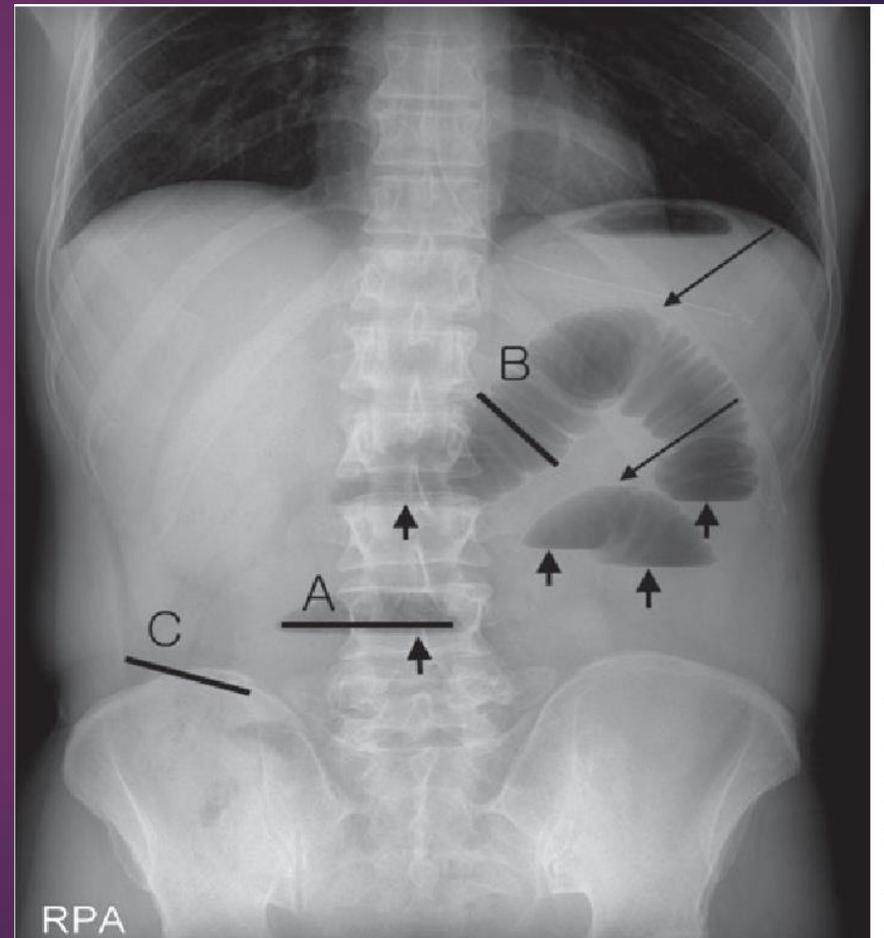
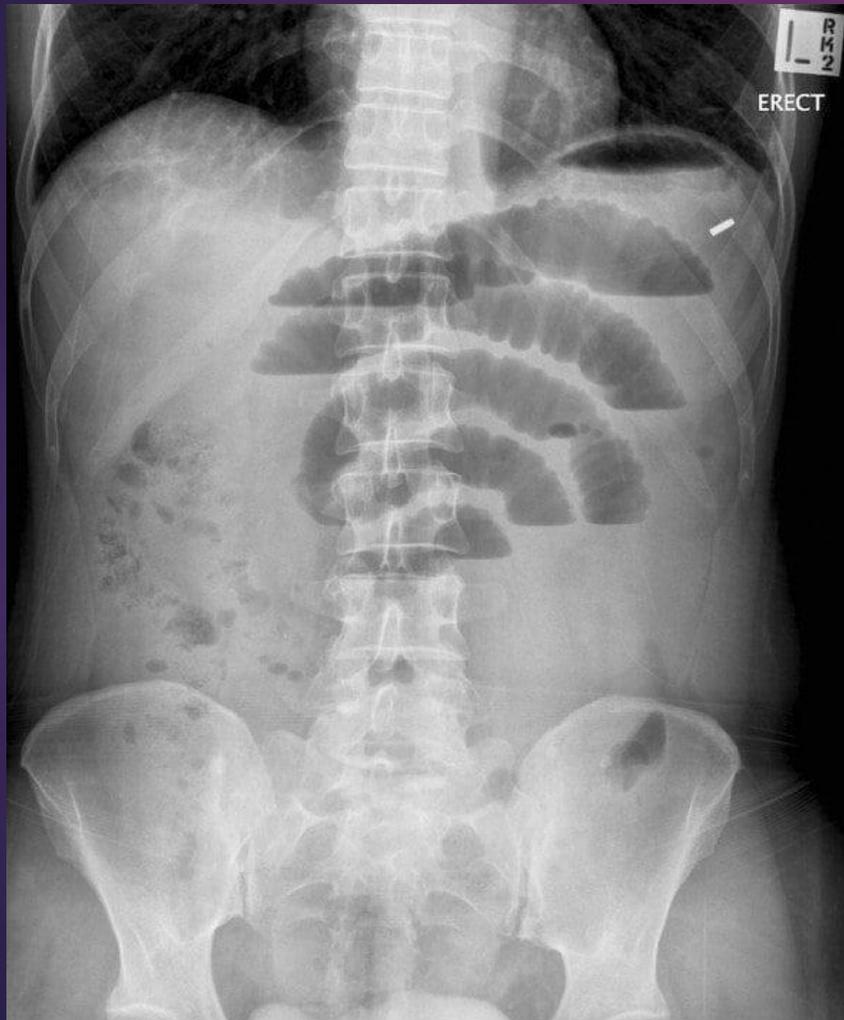
# How to divide abdomen into 4 quadrants:



# Colon obstruction: air fluid levels



# Small intestine obstruction



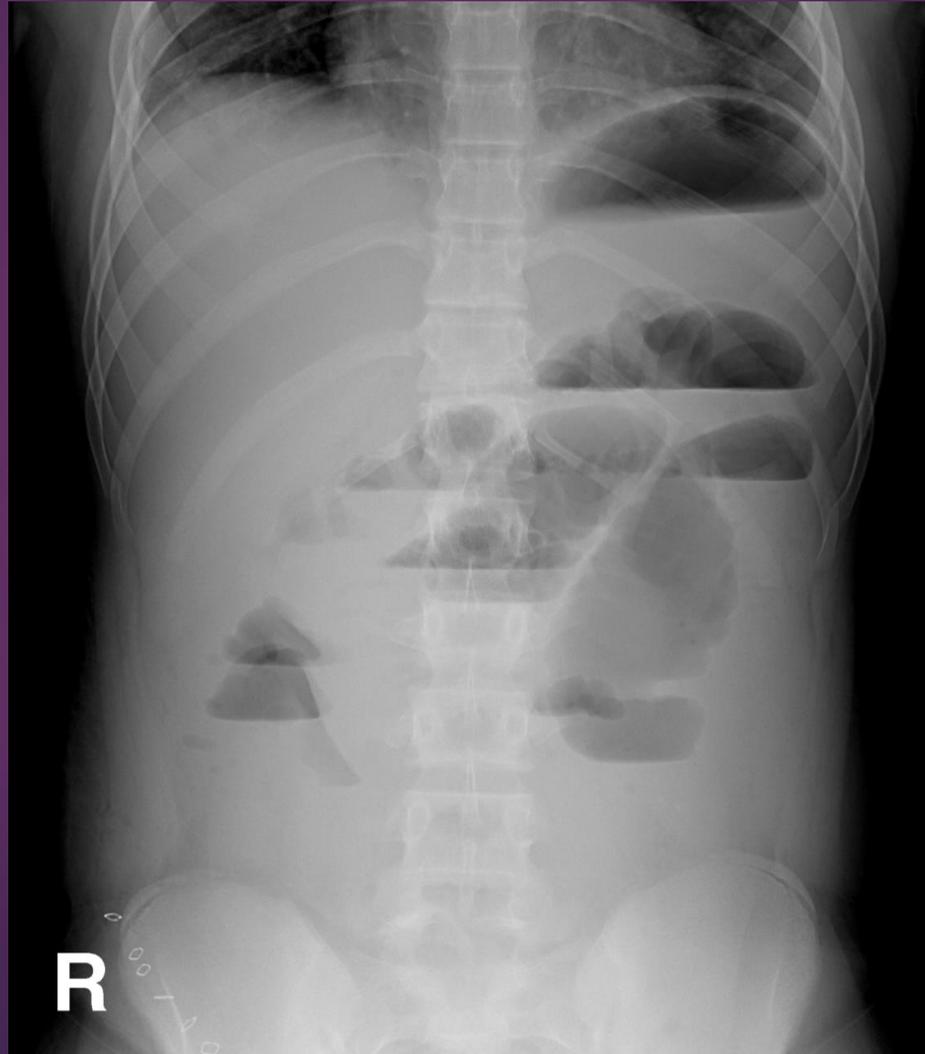
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# Mechanical small bowel obstruction

Mechanical SBO causes:

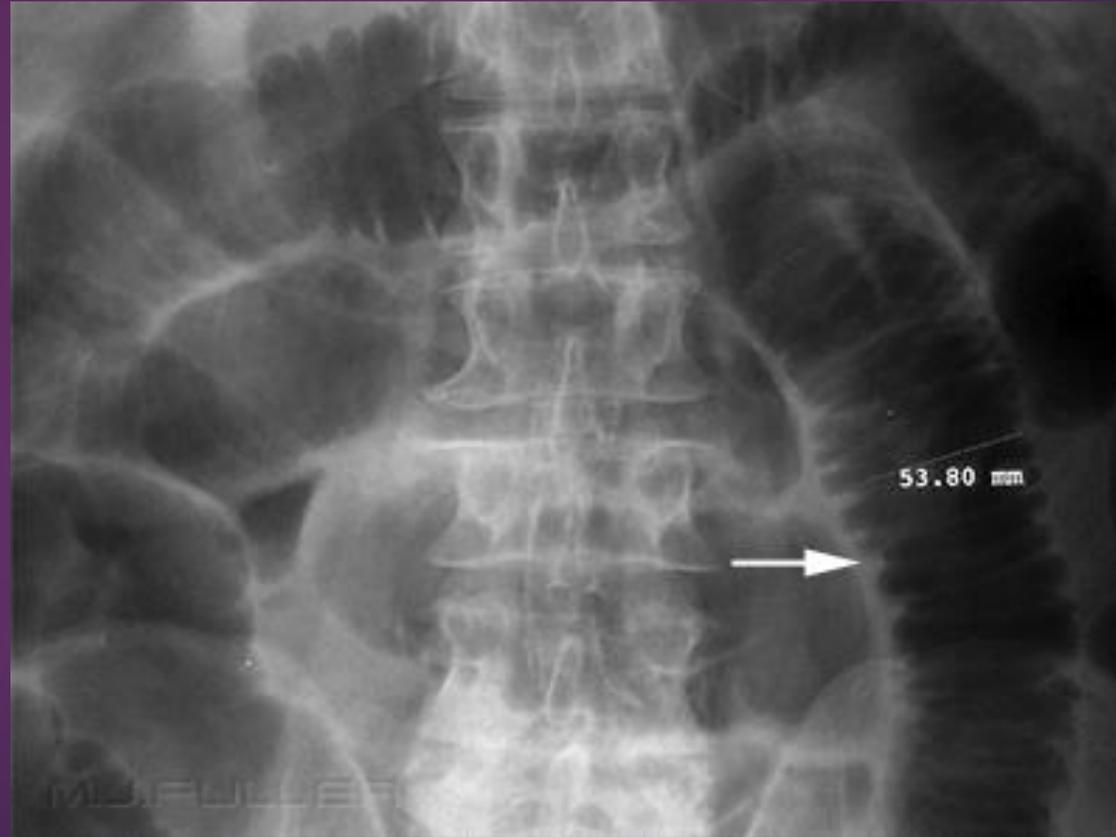
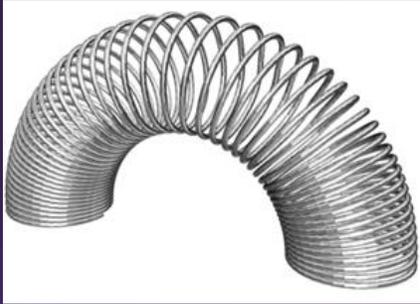
- 1-Adhesion from previous abdominal surgery (most common cause)
- 2-hernias containing bowel
- 3-neoplasm

Is this X ray normal or abnormal ? and Why?





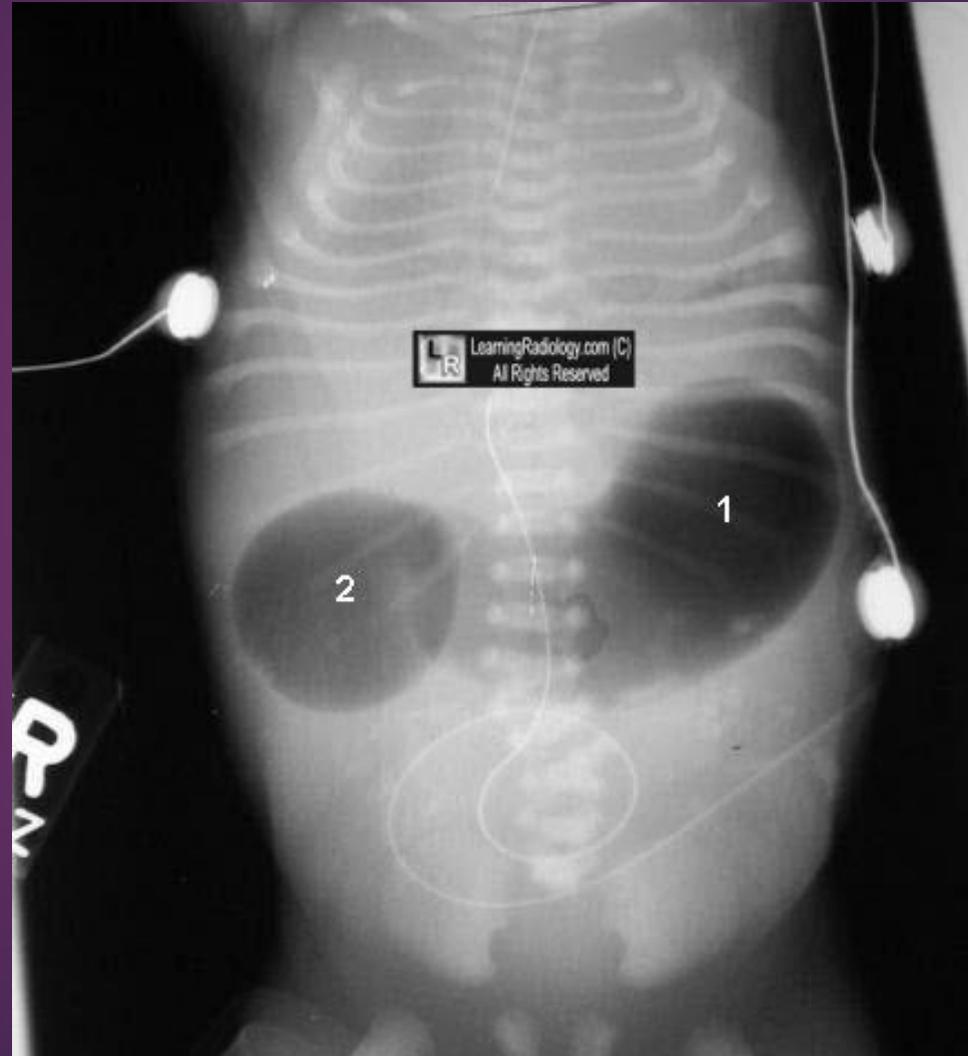
# Coil spring



# Double Bubble Sign



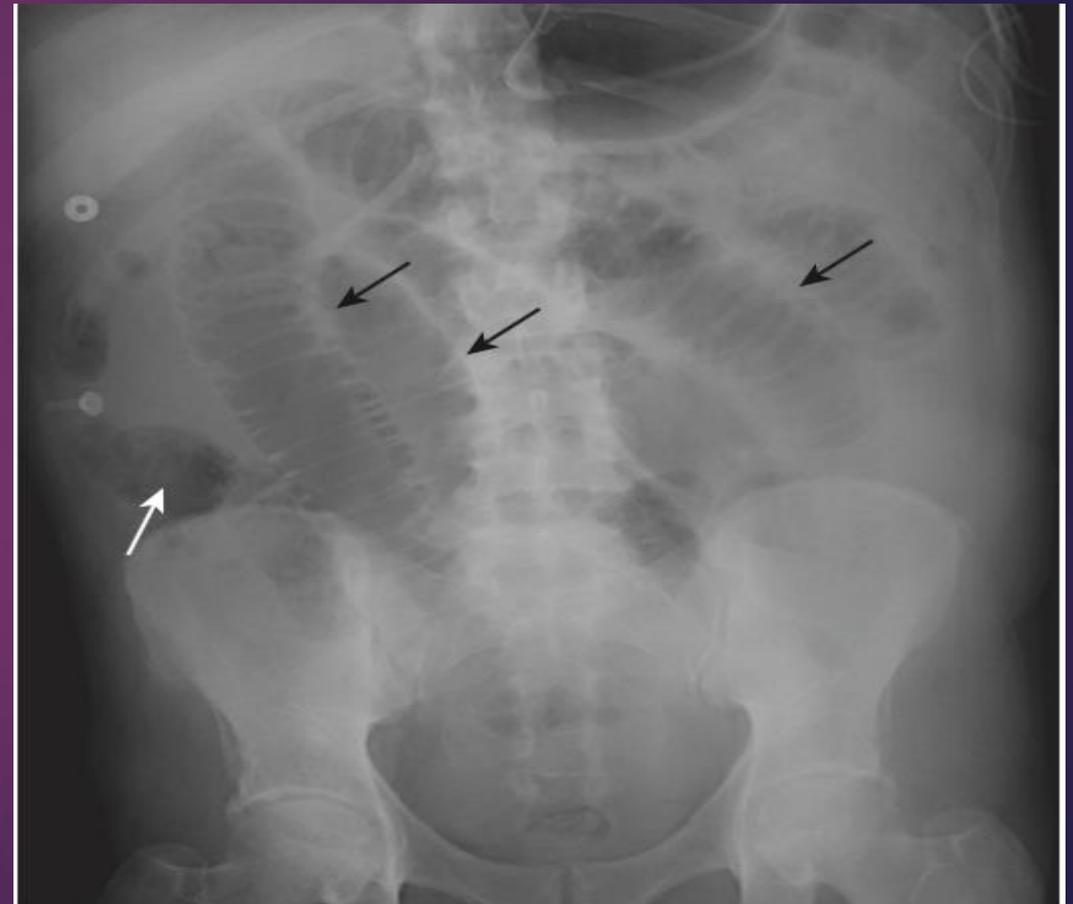
Duodenal Atresia



# 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



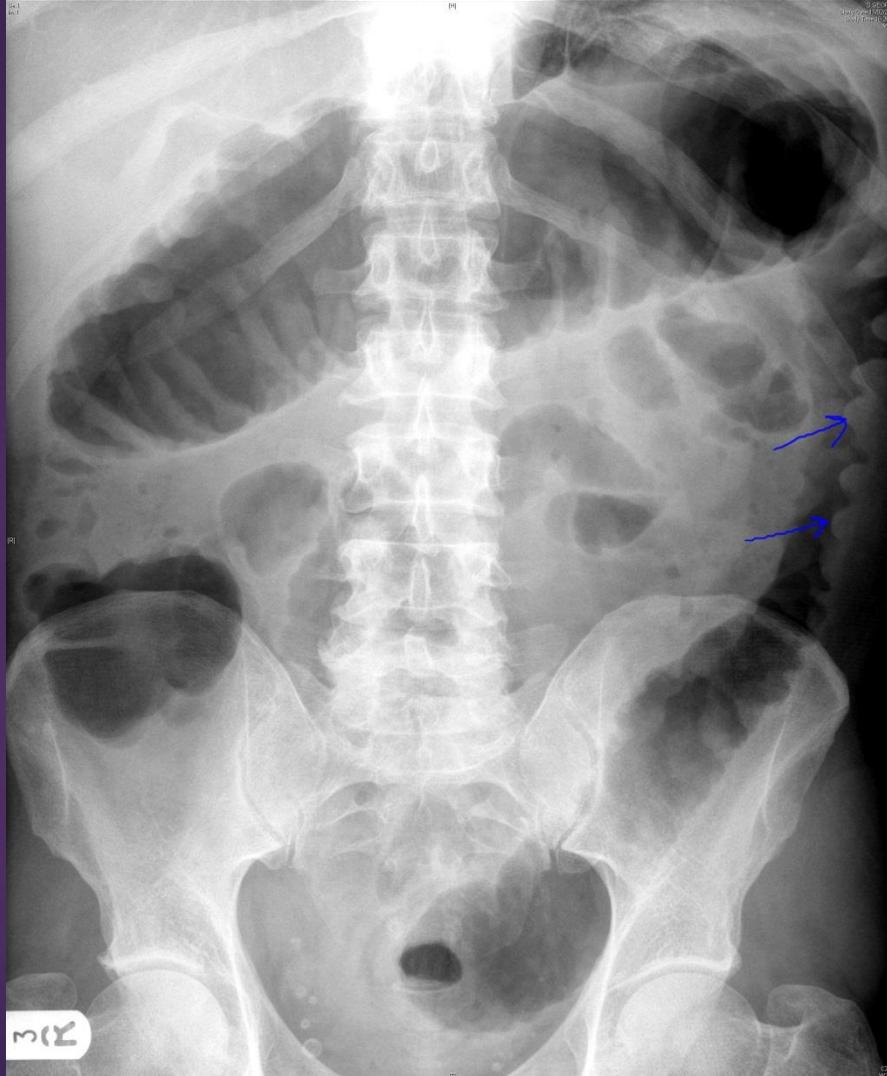
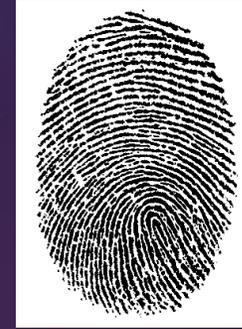
# Coffee Bean Sign

## 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

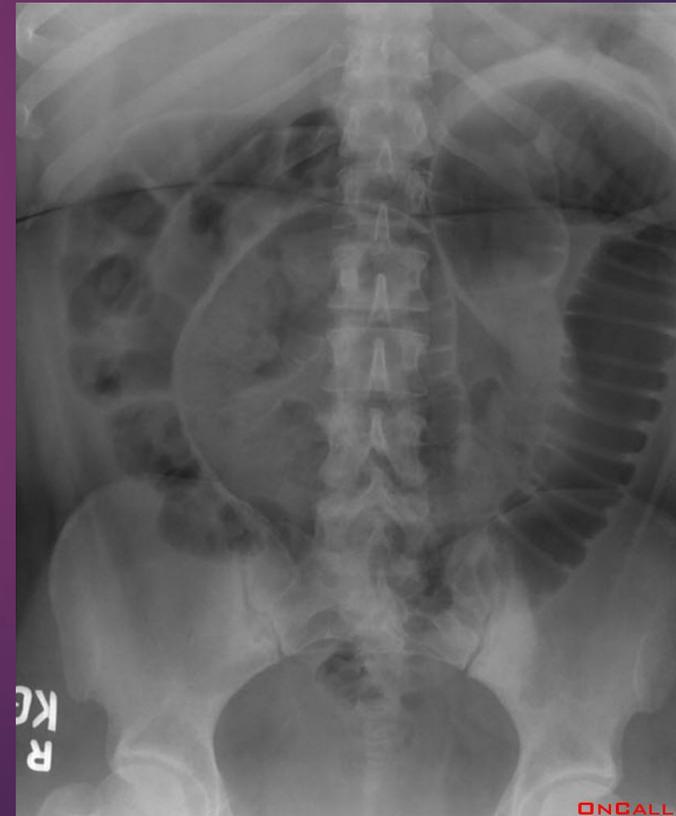
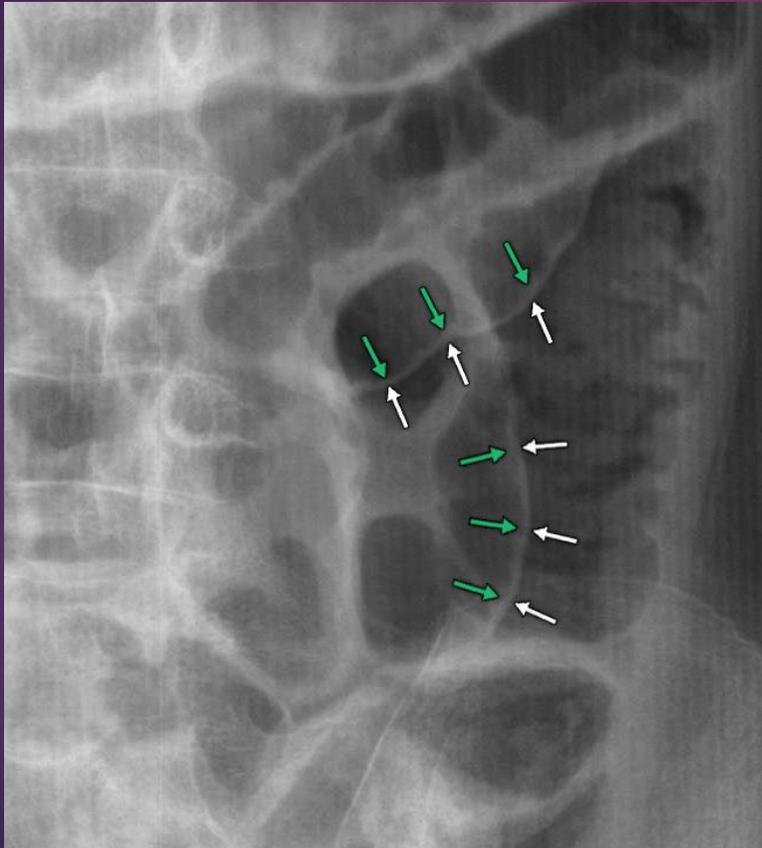
Easier to see under  
right diaphragm ? Why?

# Rigler's Sign

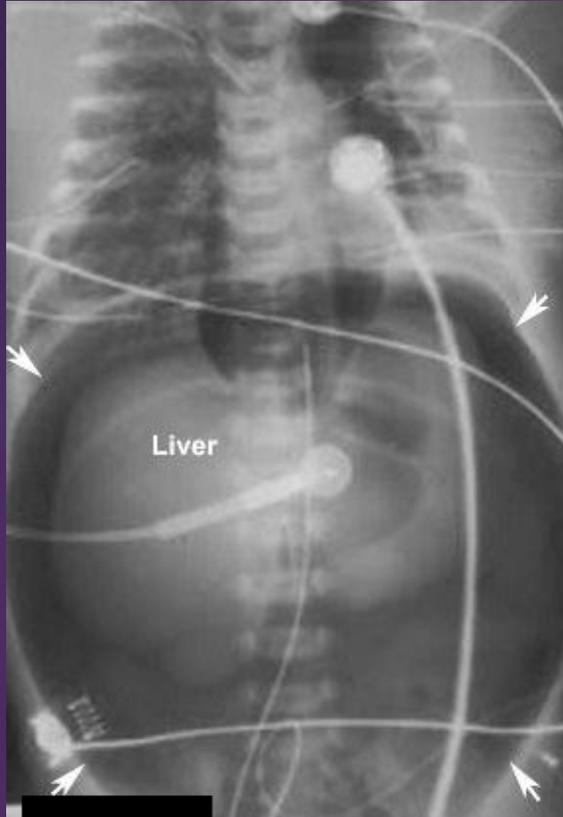
Bowel wall visualised on both sides due to intra and extraluminal air

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

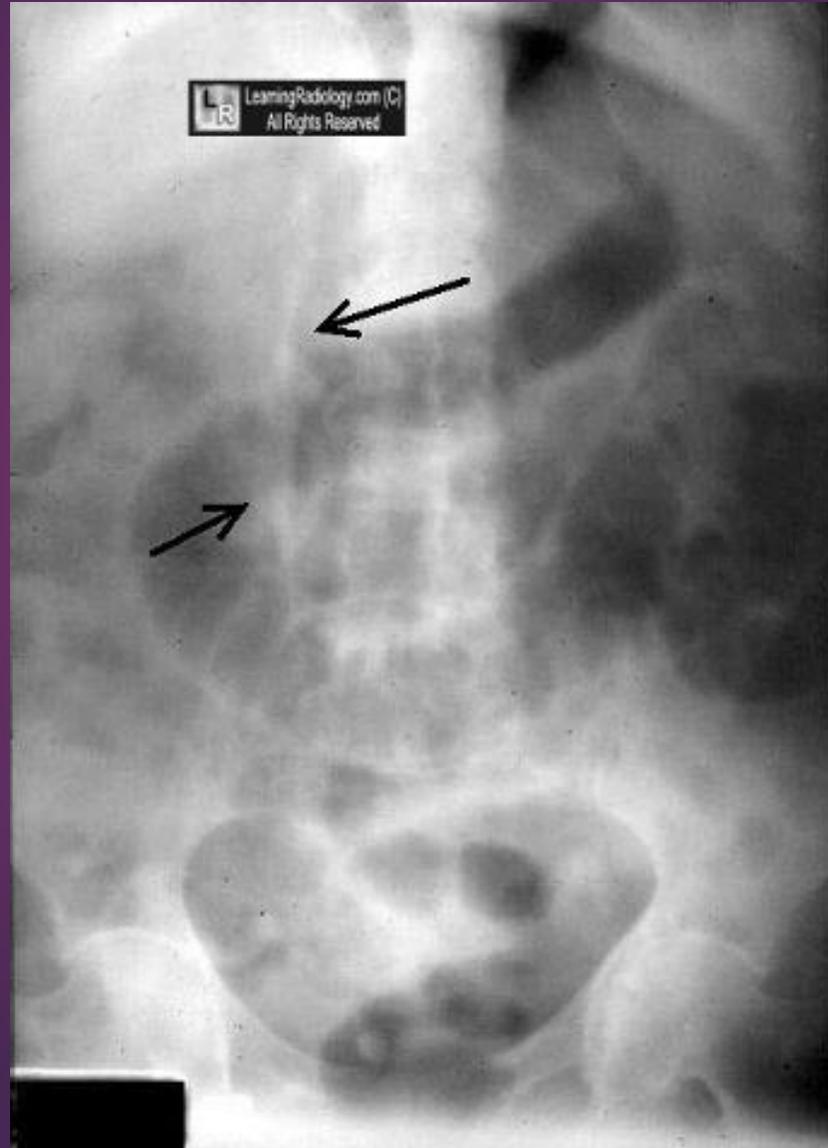
Most often in children with necrotising enterocolitis

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

3<sup>rd</sup> step in reading an x-ray

## Renal calculi



Pelvicalyceal calcifications

# Staghorn Calcification



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.

Tubular

# Bladder calculi



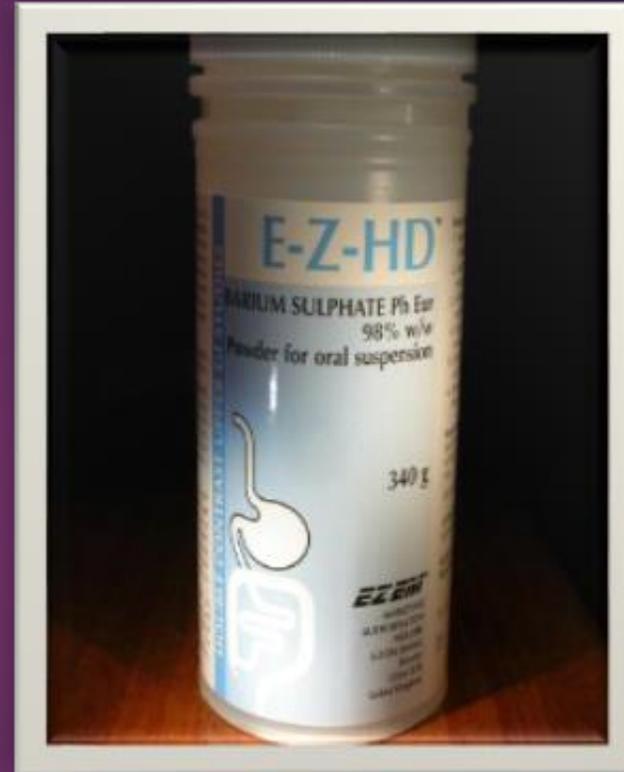
Lamellar

# 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

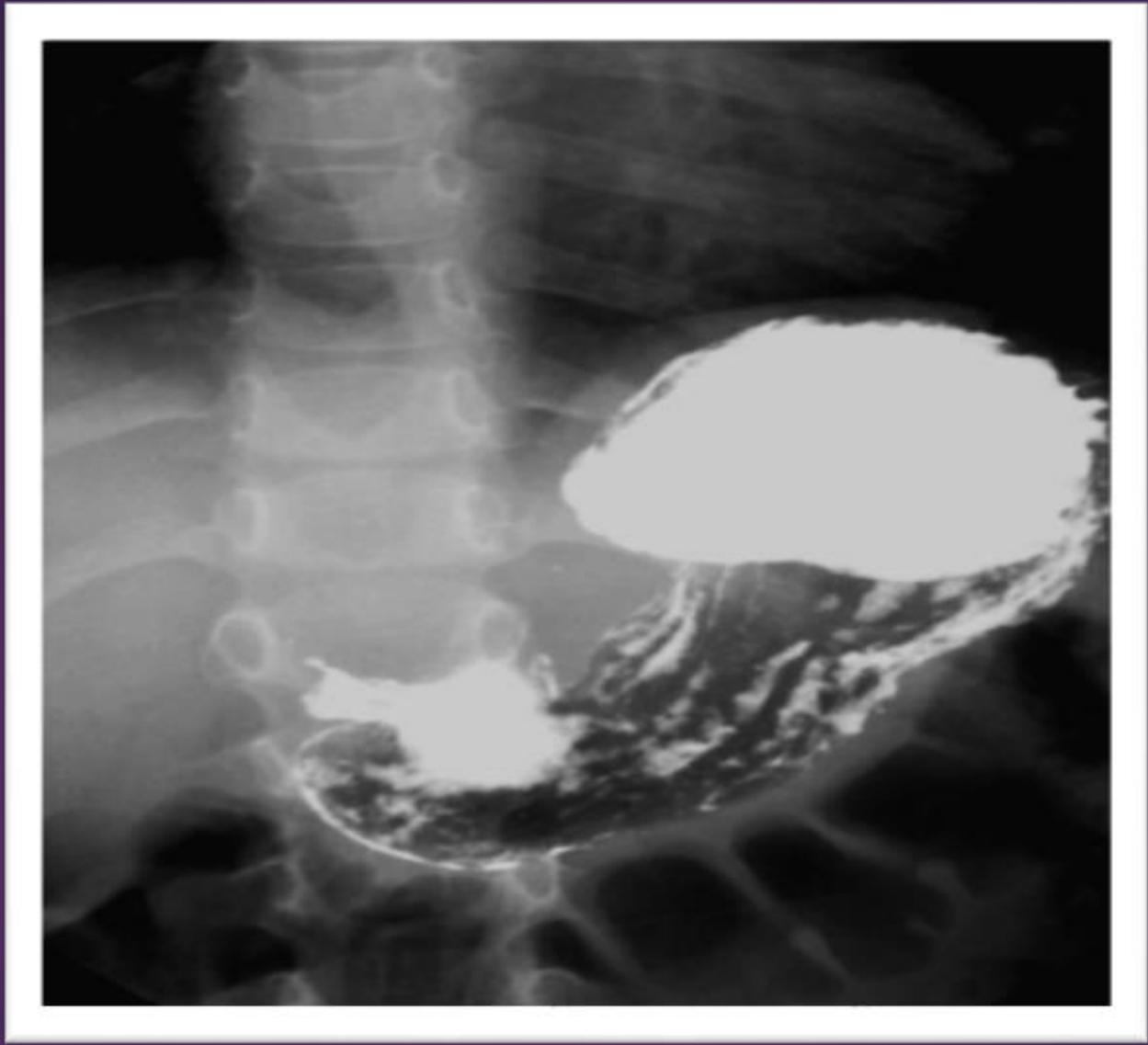
- Assessing the mucosal outline
- Abdominal pain
- Gastro esophageal reflux
- Masses
- Inflammatory bowel diseases
- Post surgical, leak

## ❖ CONTRAINDICATIONS:

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



**BARIUM SWALLOW**



**BARIUM MEAL**



**BARIUM FOLLOW THROUGH**

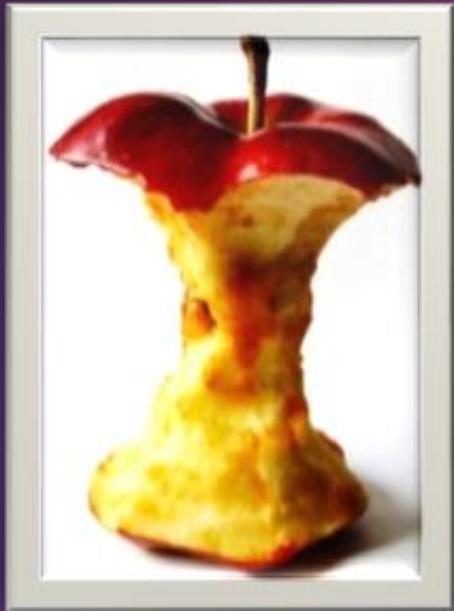


**BARIUM ENEMA**

**What is abnormal in this barium enema?**

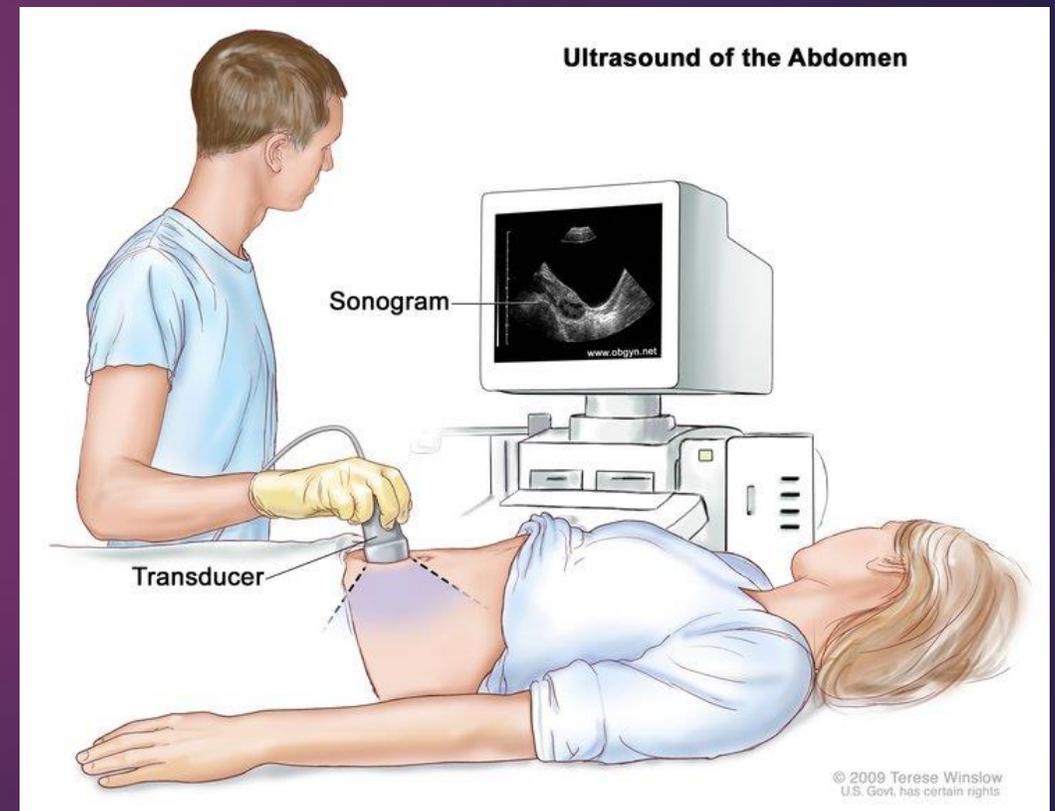


# Colon mass/malignancy (Apple core appearance)



# 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**

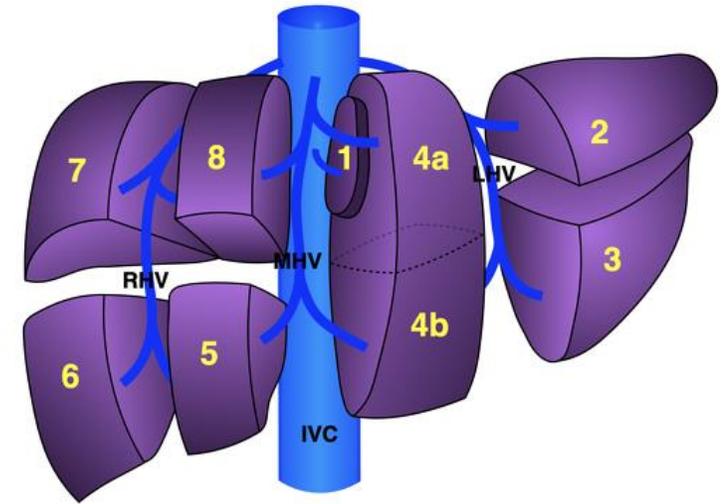
- ▶ operator dependent
- ▶ large patients can be challenging to image with ultrasound

## ▶ **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

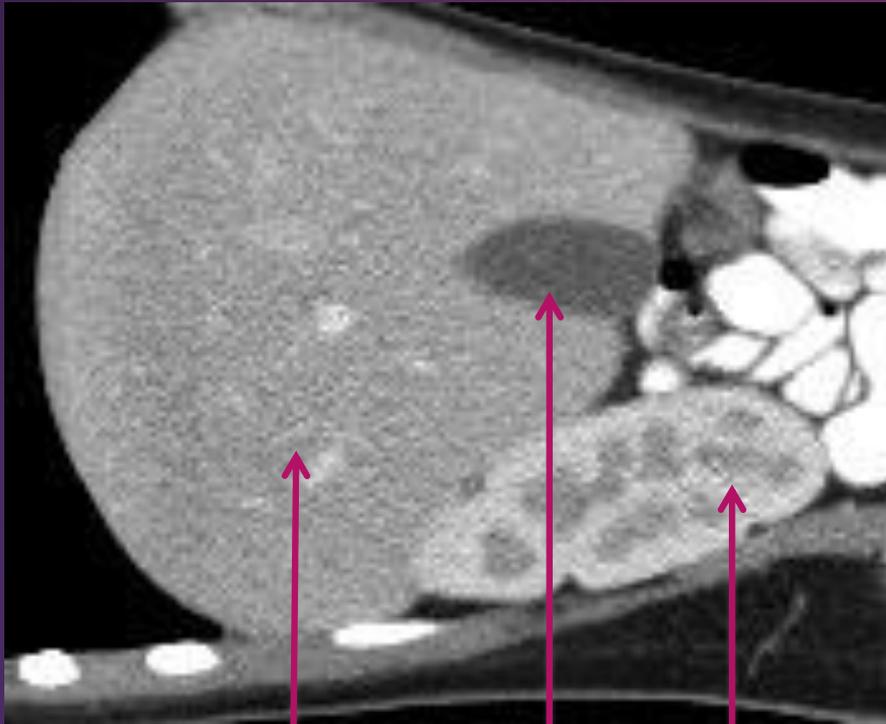


Craig Hacking  
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Radiopaedia.org



# Liver/gallbladder

CT – sagittal cut

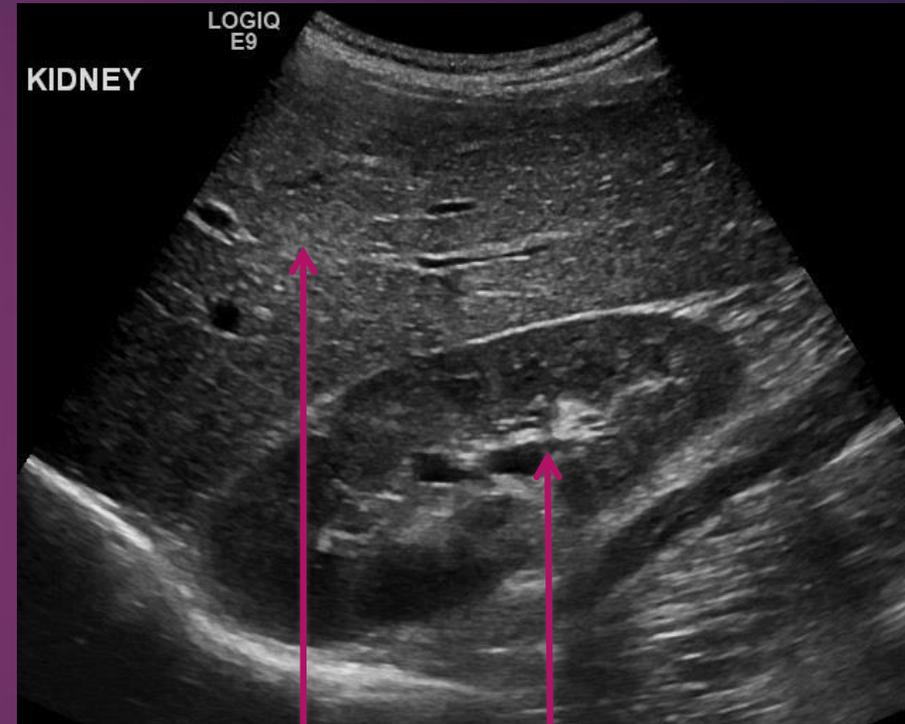


Liver

Gallbladder

Right kidney

U/S – longitudinal orientation

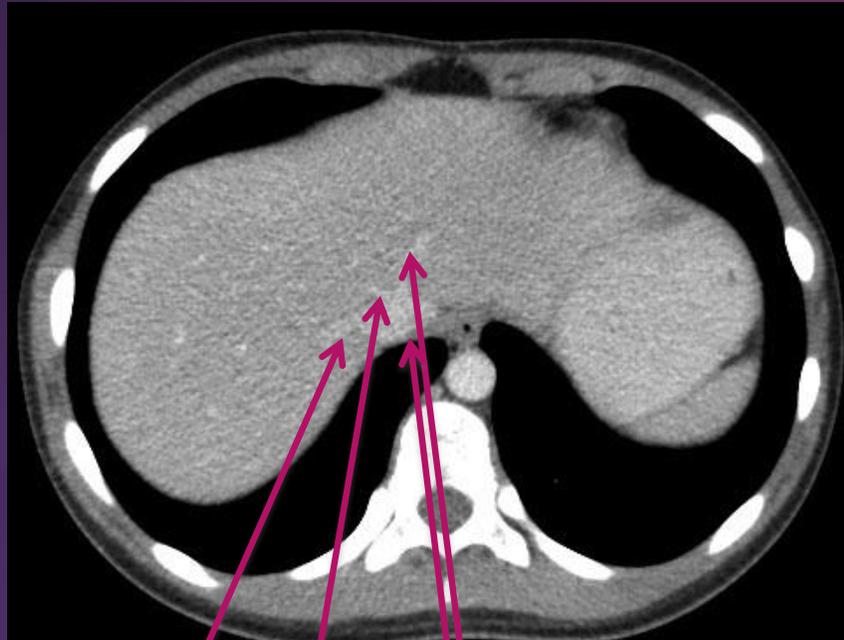


Liver

Right kidney

# Liver/gallbladder

CT – axial cut



Right, middle, and left hepatic veins

Draining into the IVC

U/S – transverse orientation

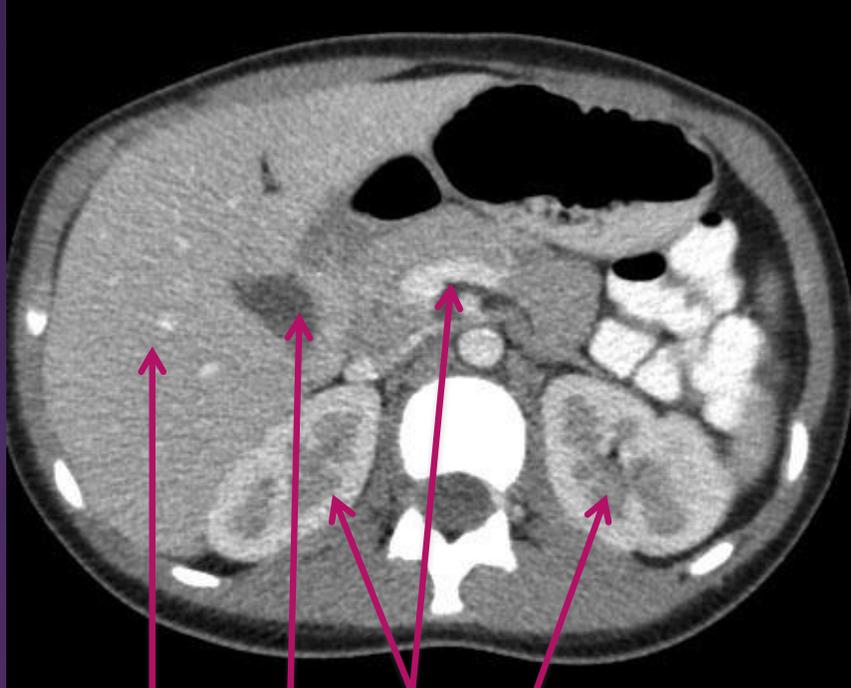


Right, middle, and left hepatic veins

Draining into the IVC

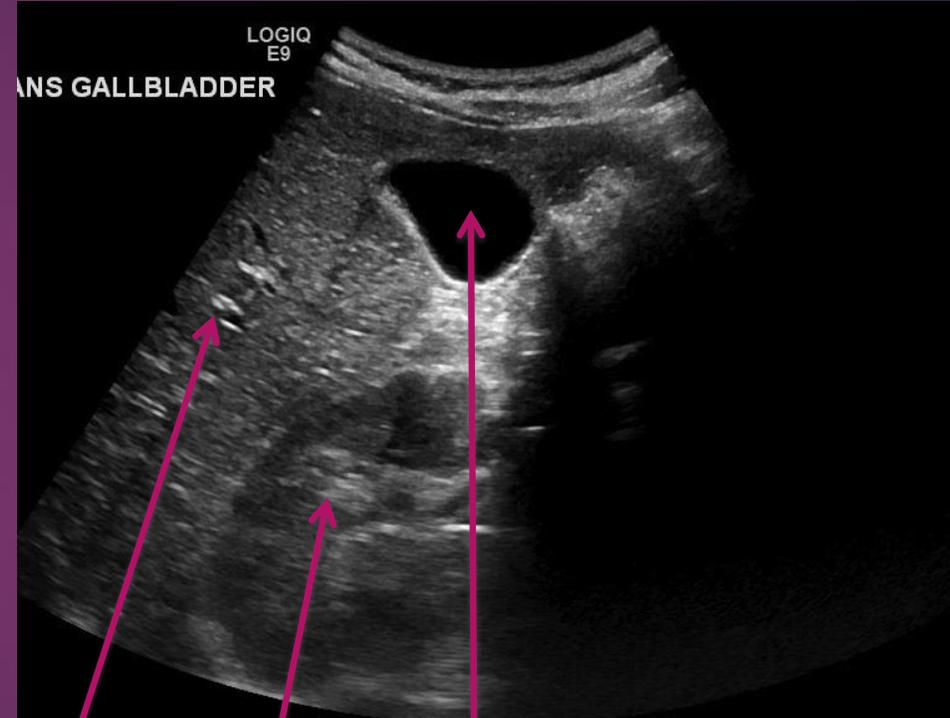
# Liver/gallbladder

CT – axial cut



Liver  
Gallbladder  
Kidneys  
Splenic vein

U/S – transverse orientation



Liver  
Right kidney  
Gallbladder

# Liver/gallbladder

CT – axial cut



Right portal vein

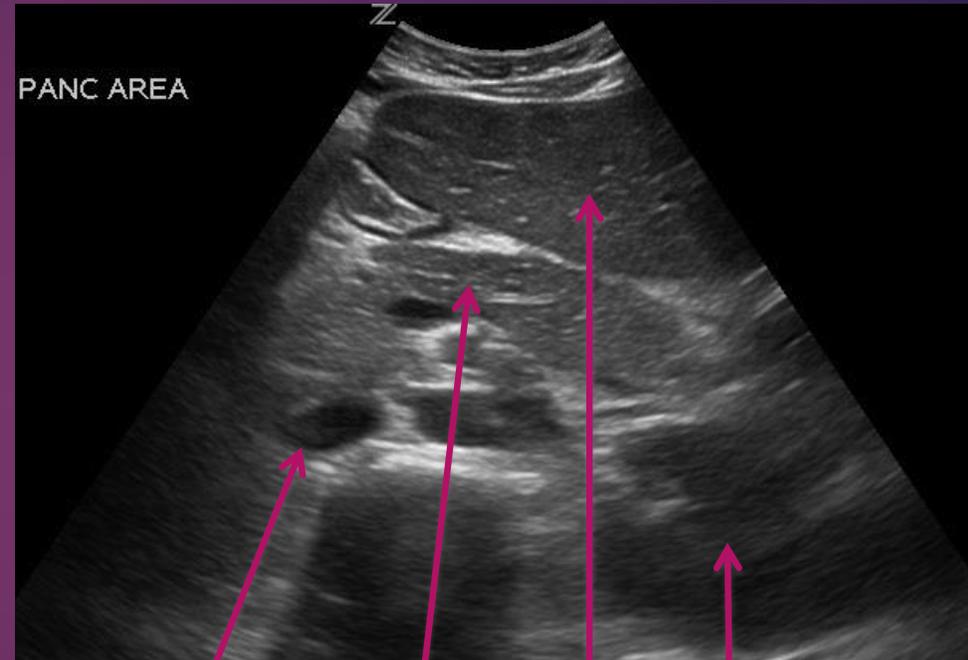
IVC

Aorta

Splenic vein

Spleen

U/S – transverse orientation



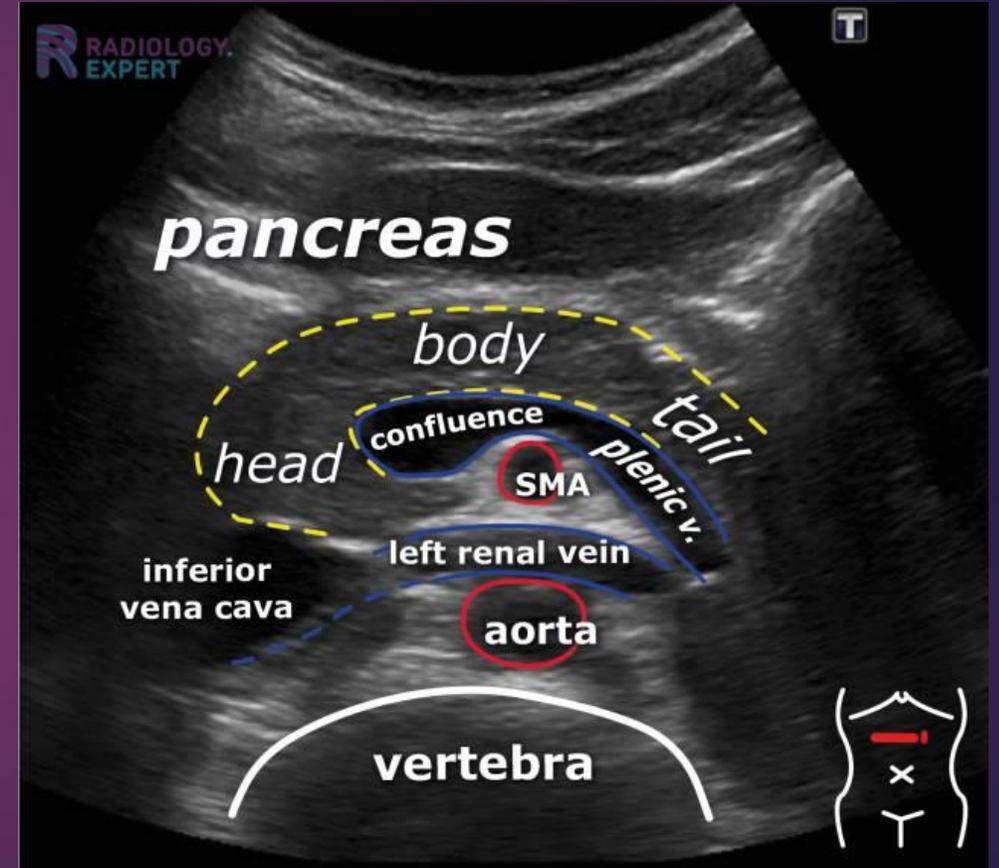
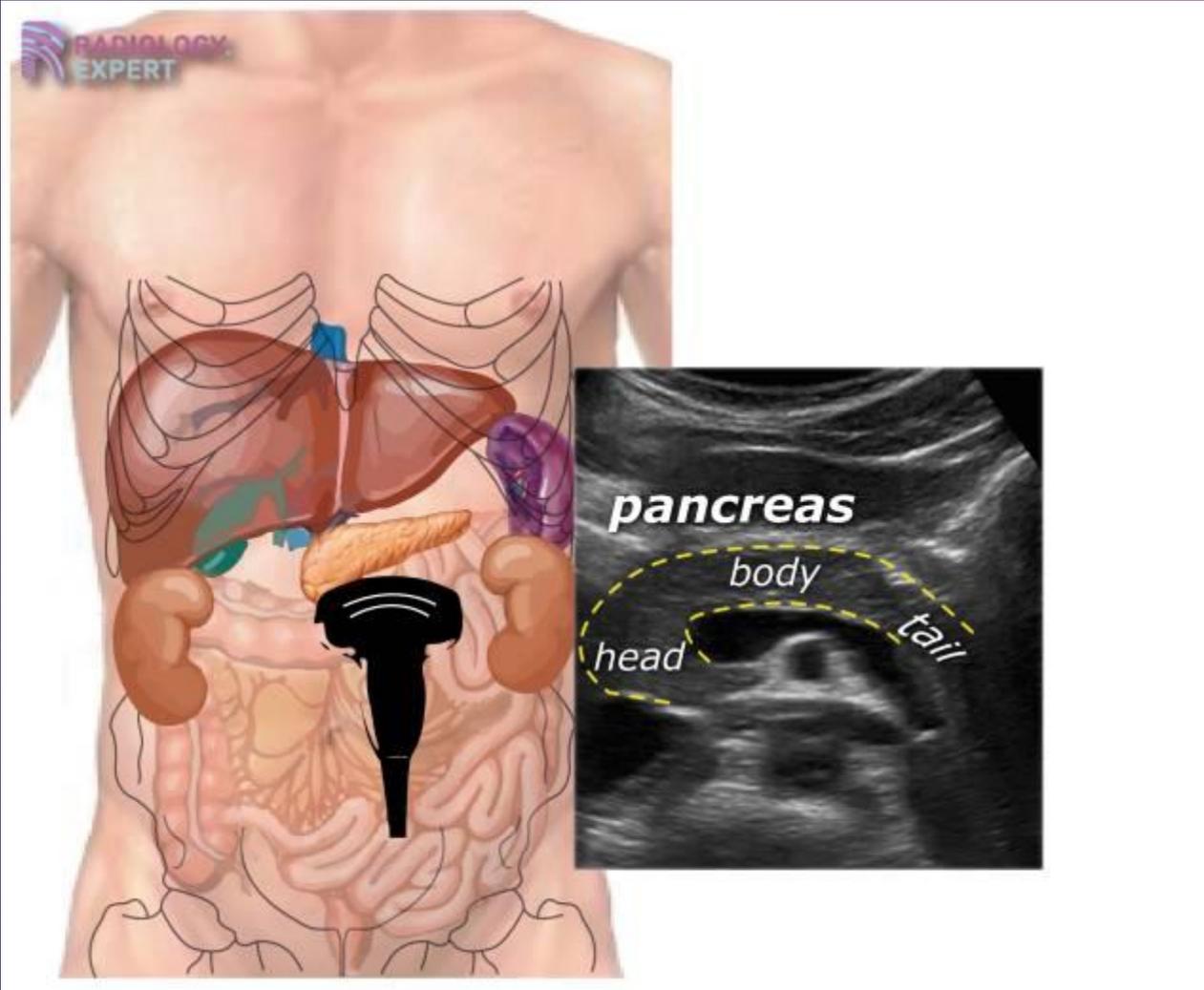
IVC

Pancreas

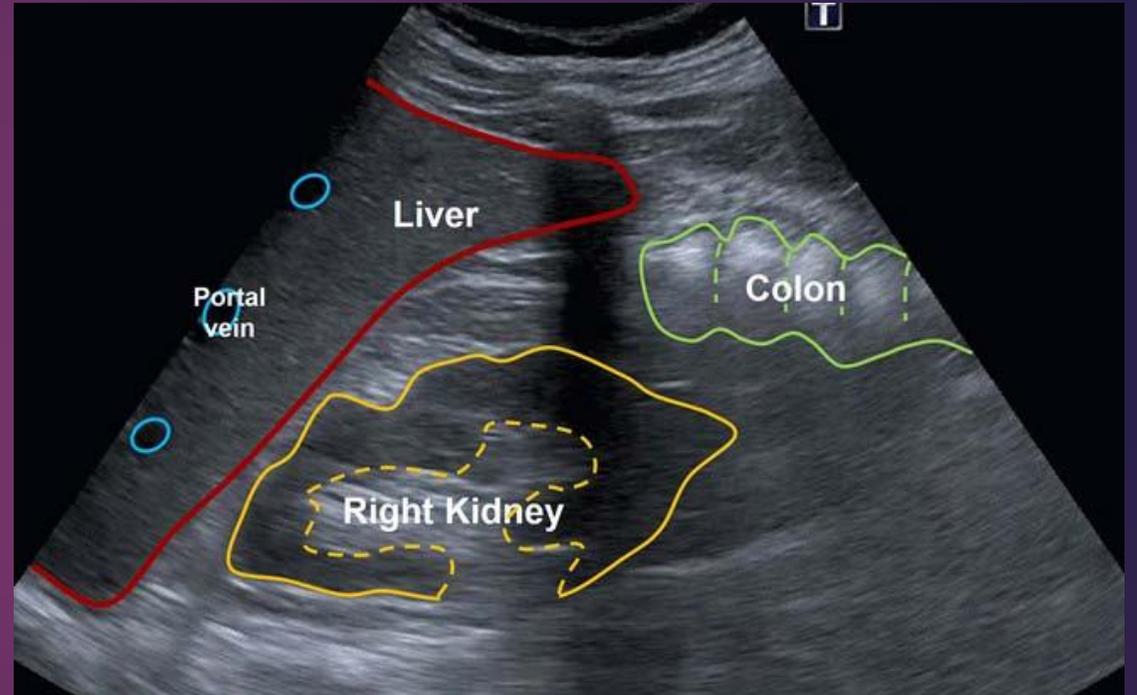
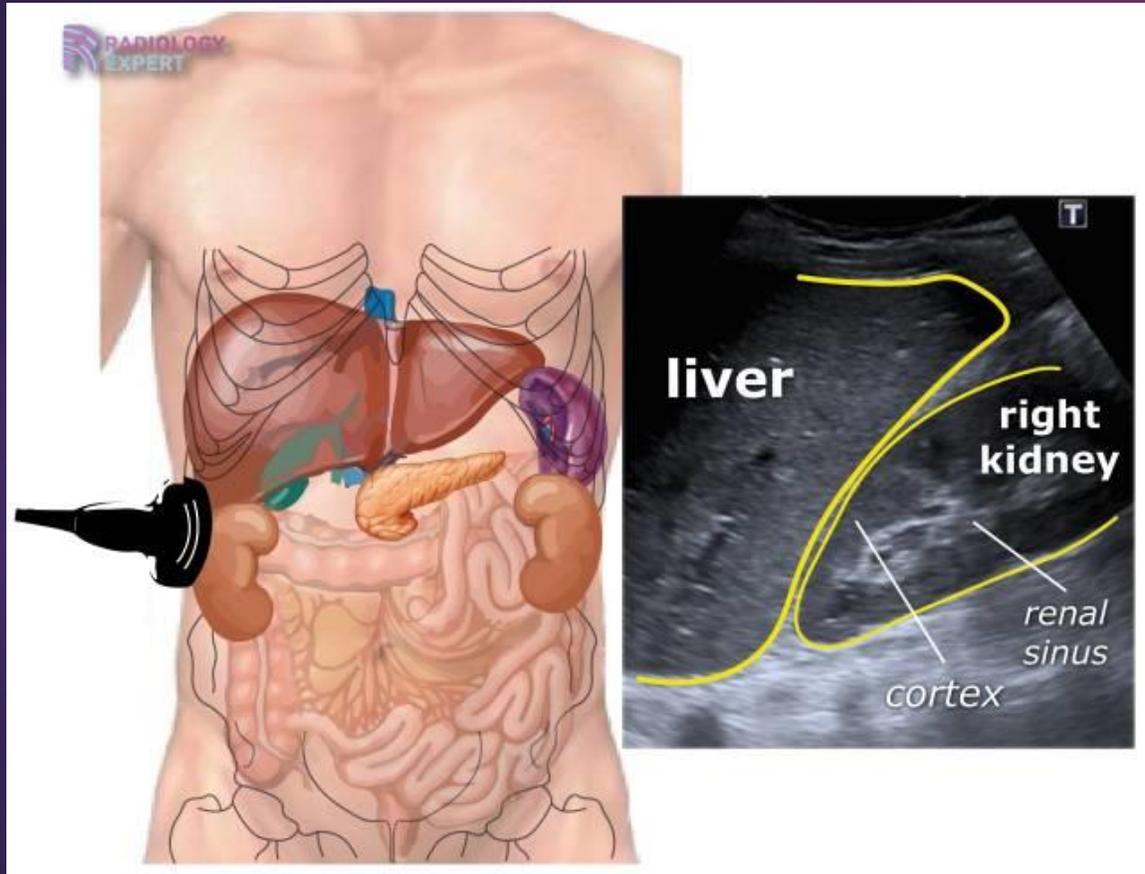
Left lobe of liver

Left kidney

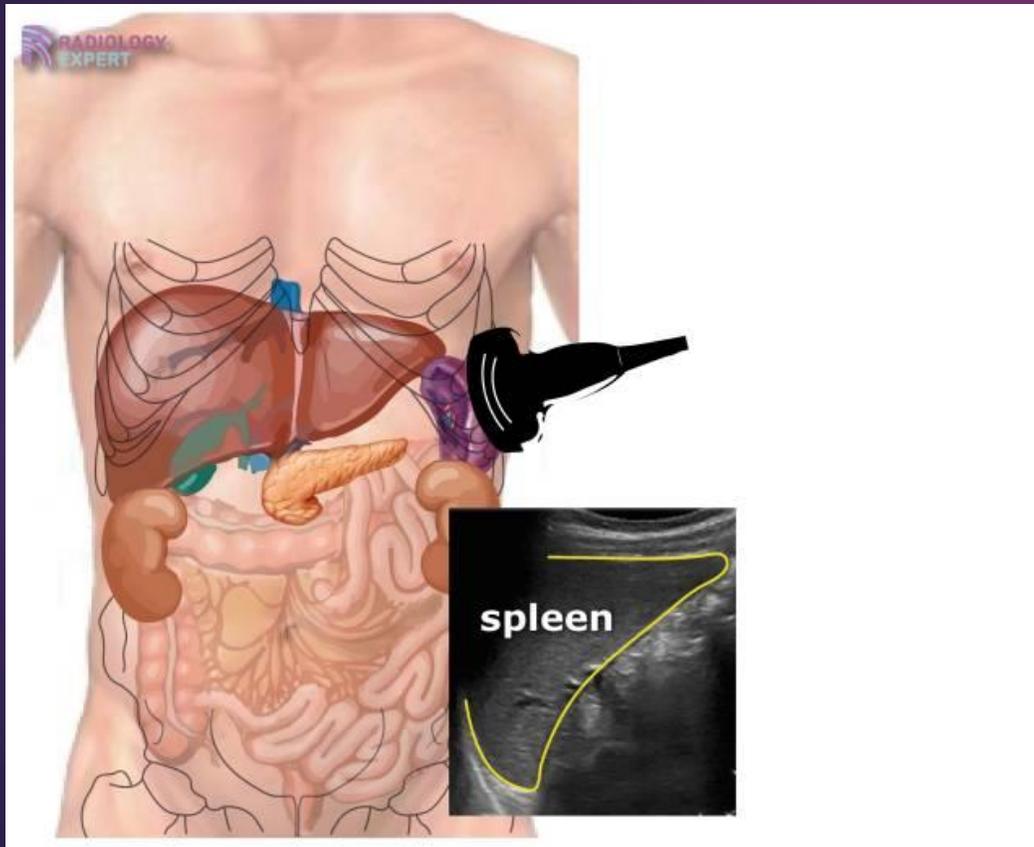
# Pancreas



# Right kidney



# Spleen and left kidney



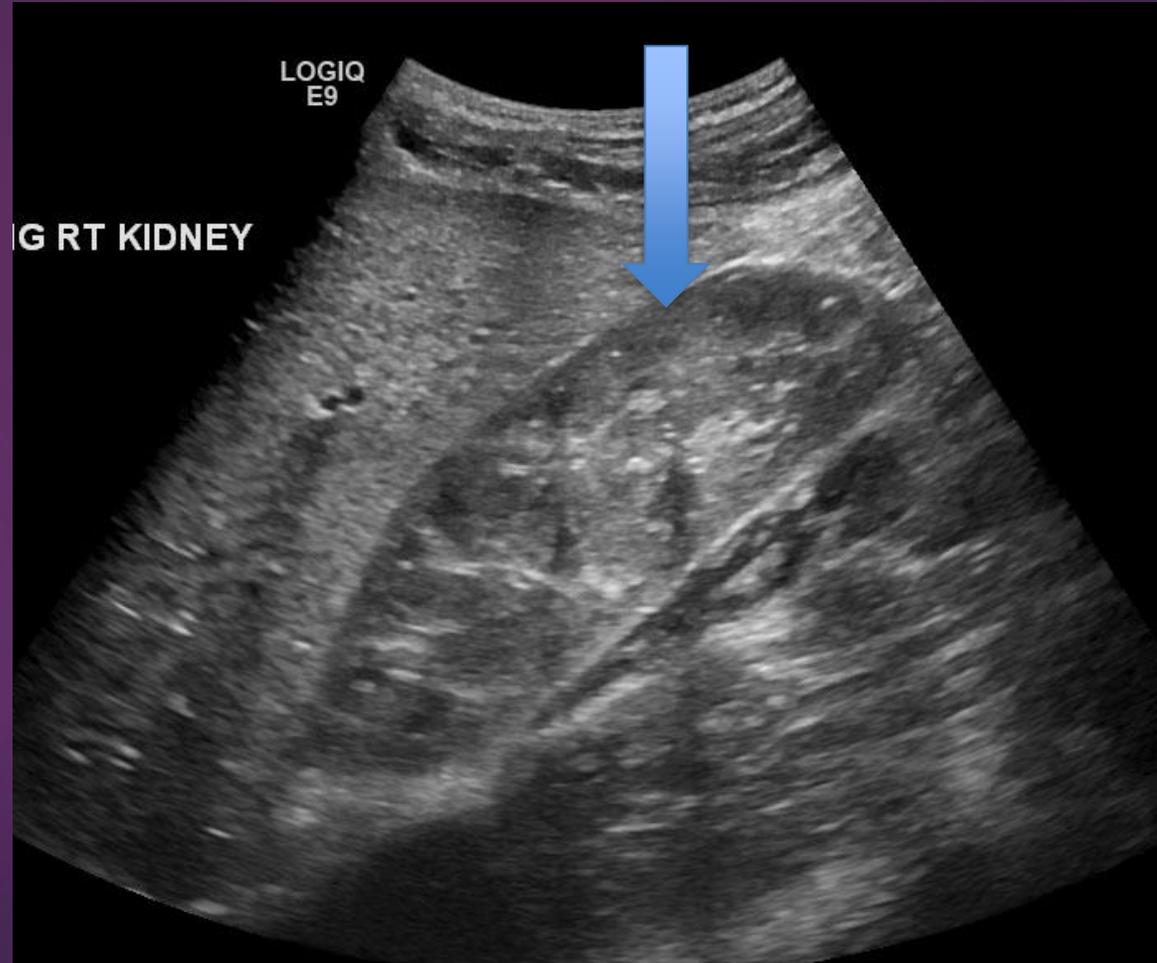
# Aorta



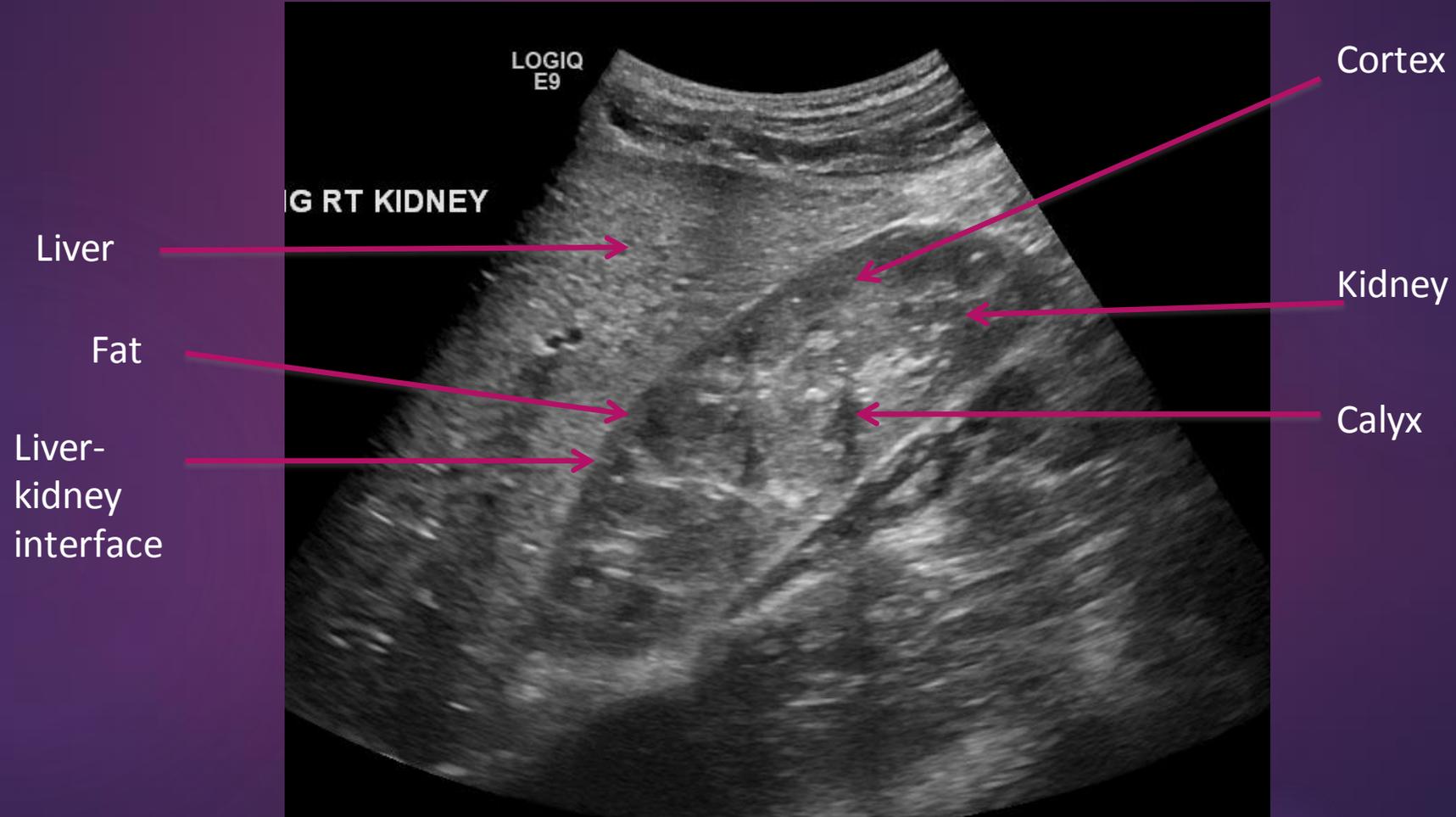
# Indications

- ▶ 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

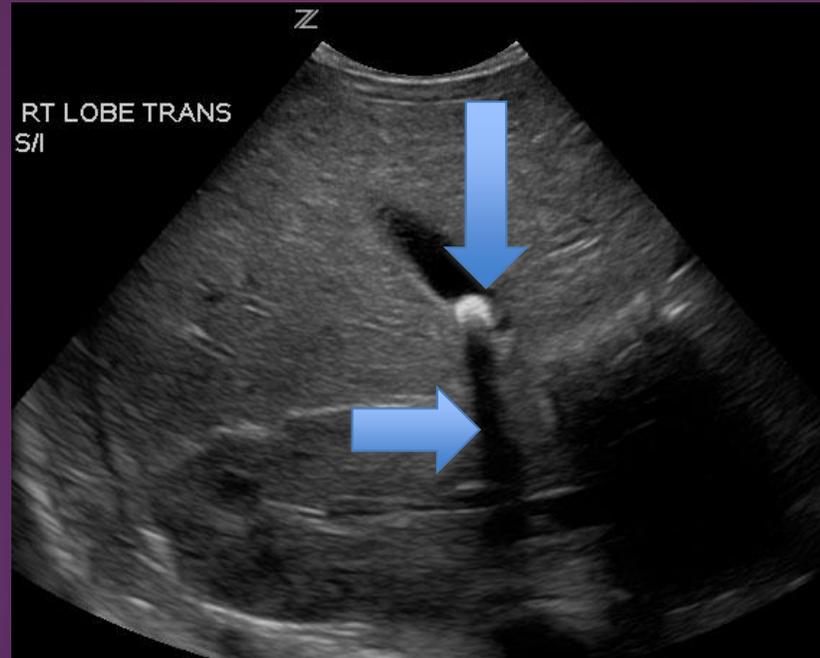
Kidneys – parenchyma hypoechoic to liver



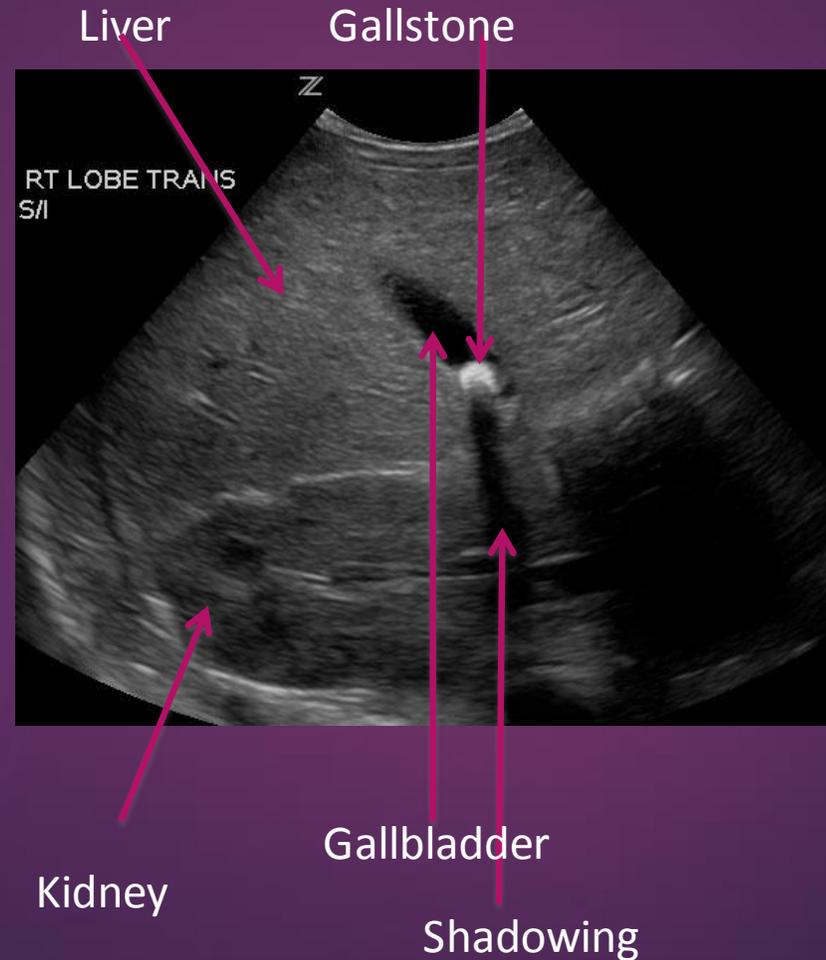
# Kidneys – parenchyma hypoechoic to liver



# Gallstones – hyperechoic and shadowing underneath



# Gallstones – hyperechoic and shadowing underneath



# 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:**

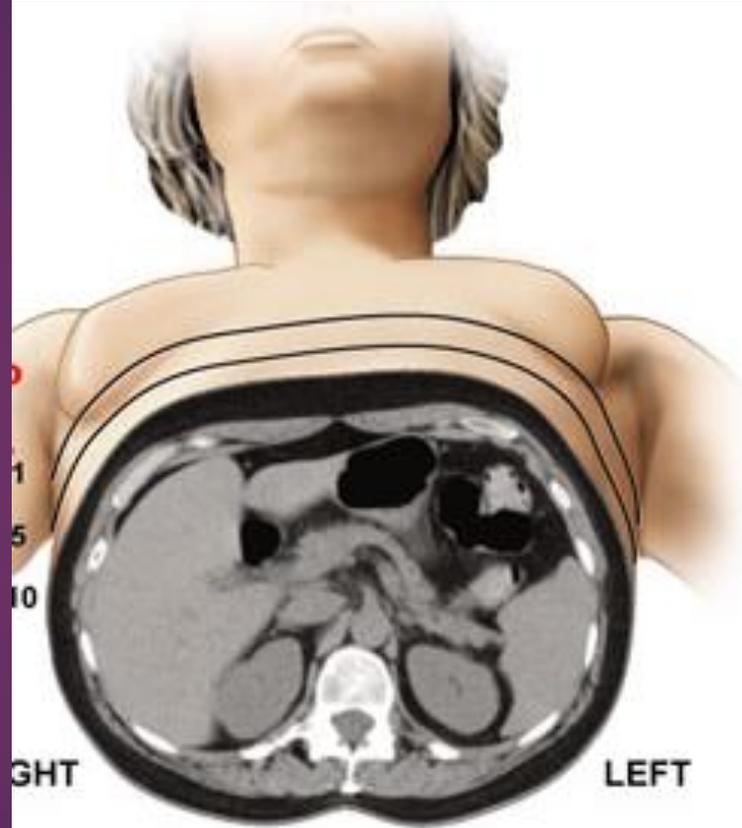
- uses ionizing radiation
  - risk of radiation-induced cancer
  - approximately 100 times the dose of a chest radiograph
- requires iodinated IV contrast
  - risk of renal impairment
  - risk of anaphylactic reaction

## **Important pathology:**

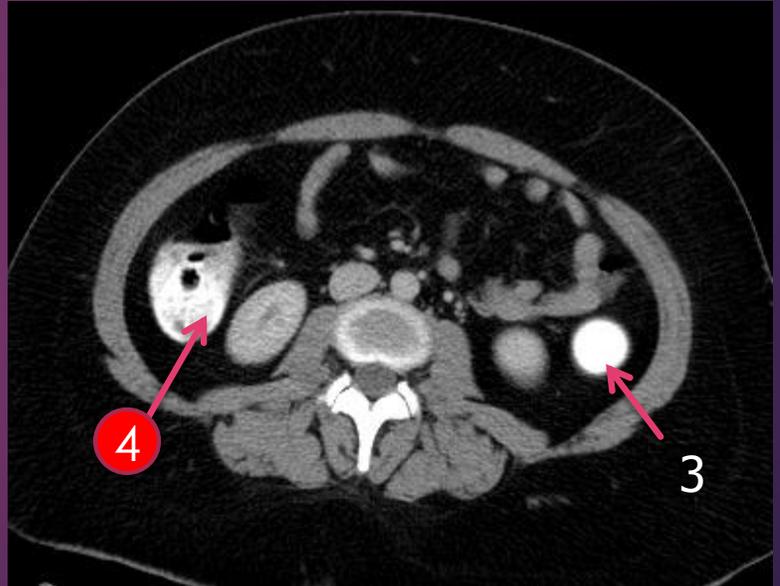
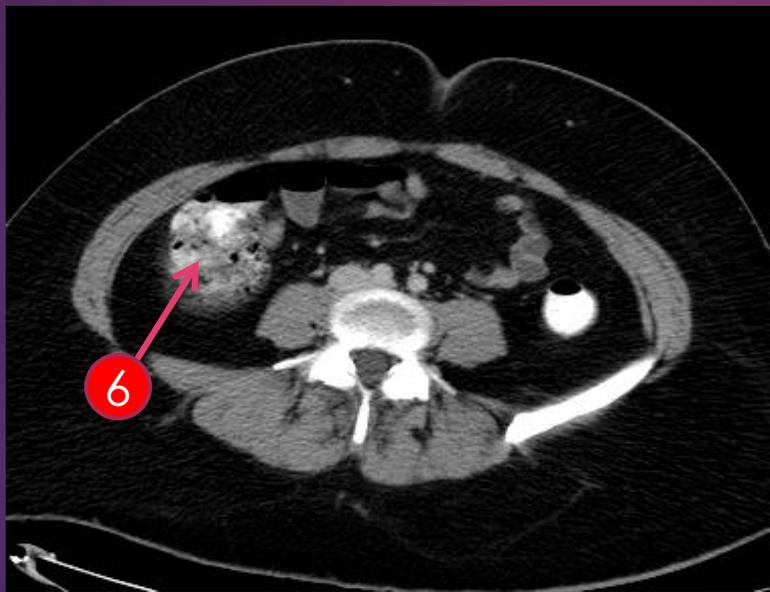
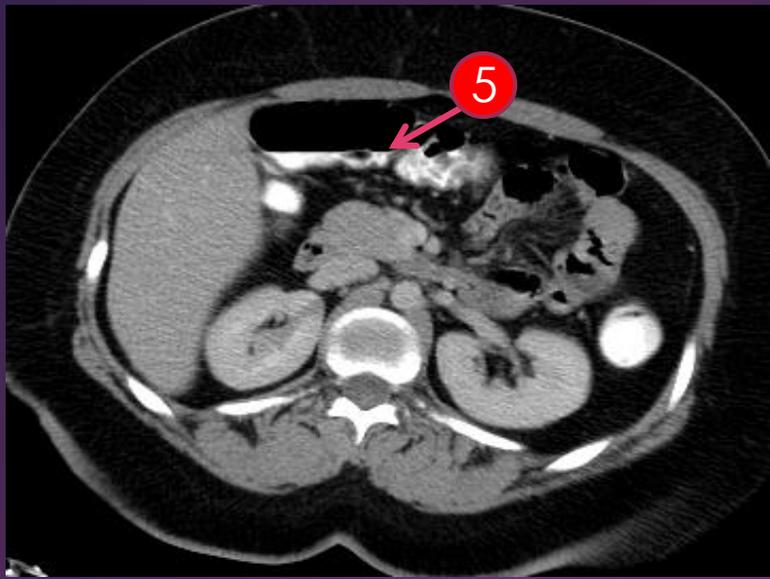
bowel obstruction  
bowel perforation  
colon cancer  
intra-abdominal trauma

# 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



**CT scans are viewed from below**



1- Rectum

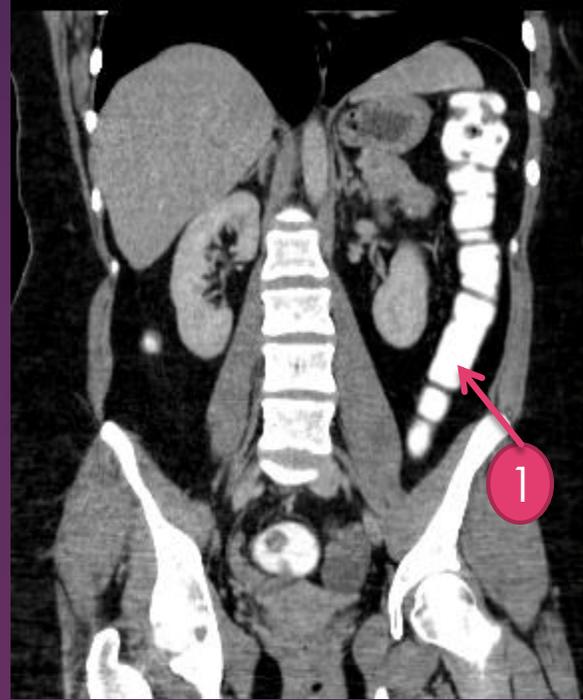
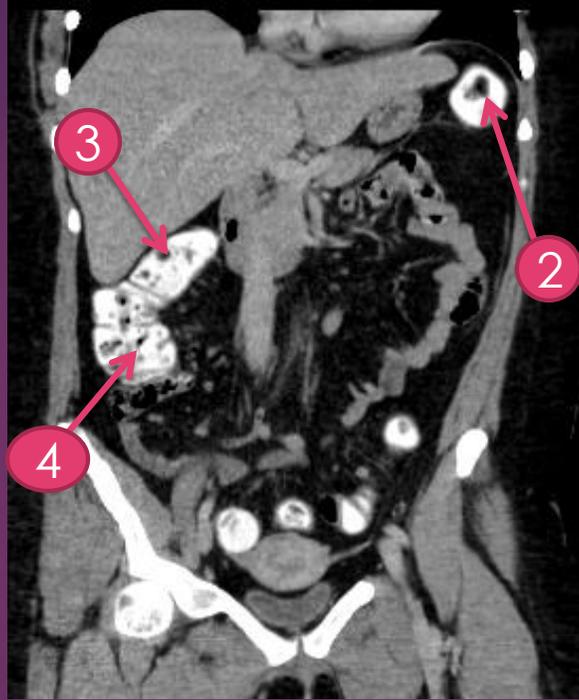
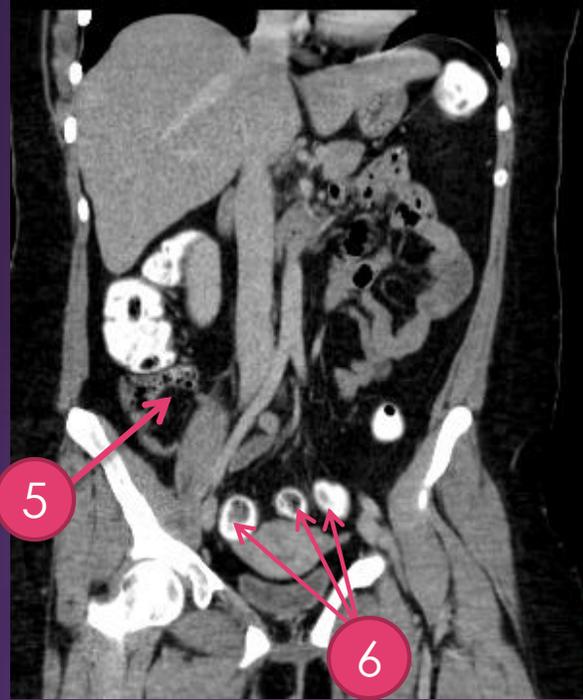
2-Sigmoid colon

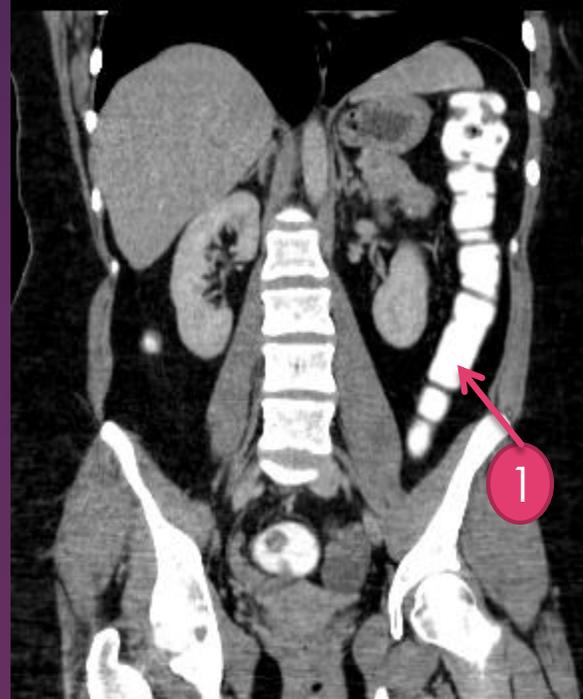
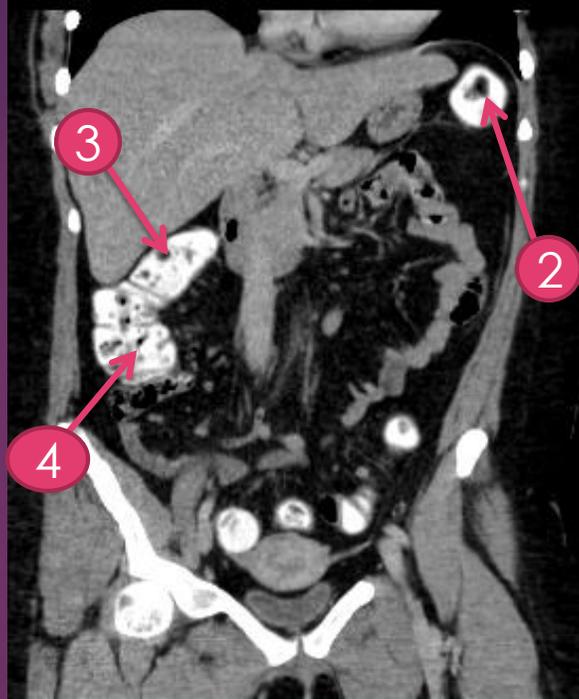
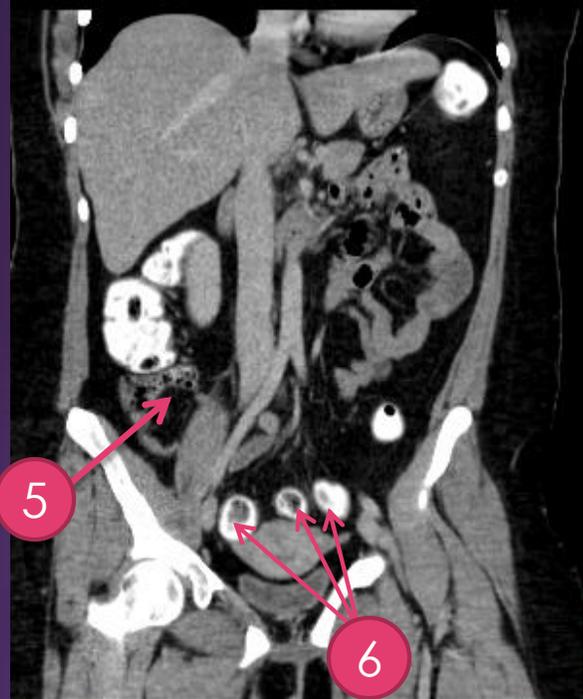
3-Descending colon

4-Ascending colon

5-Transverse colon

6-Cecum



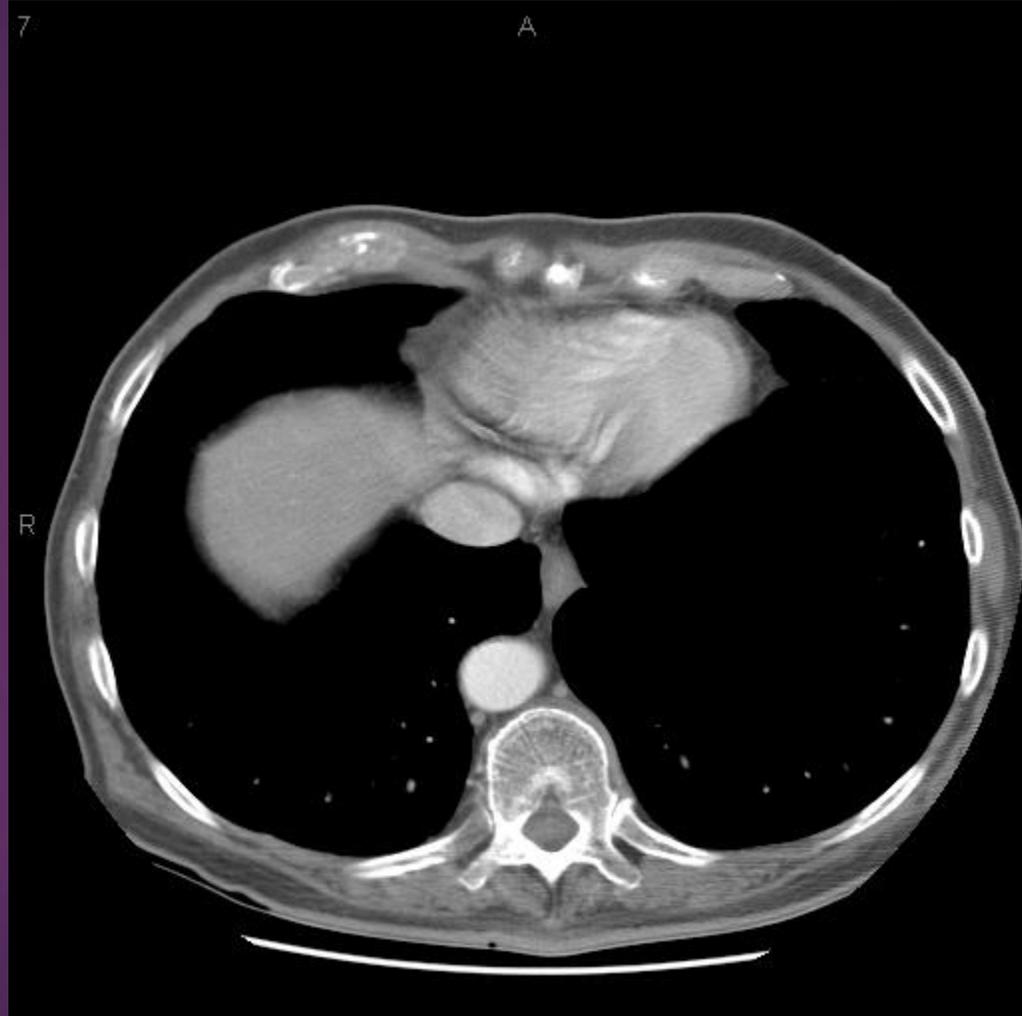


1. Descending colon
2. Splenic flexure
3. Hepatic flexure
4. Ascending colon
5. cecum
6. Sigmoid colon





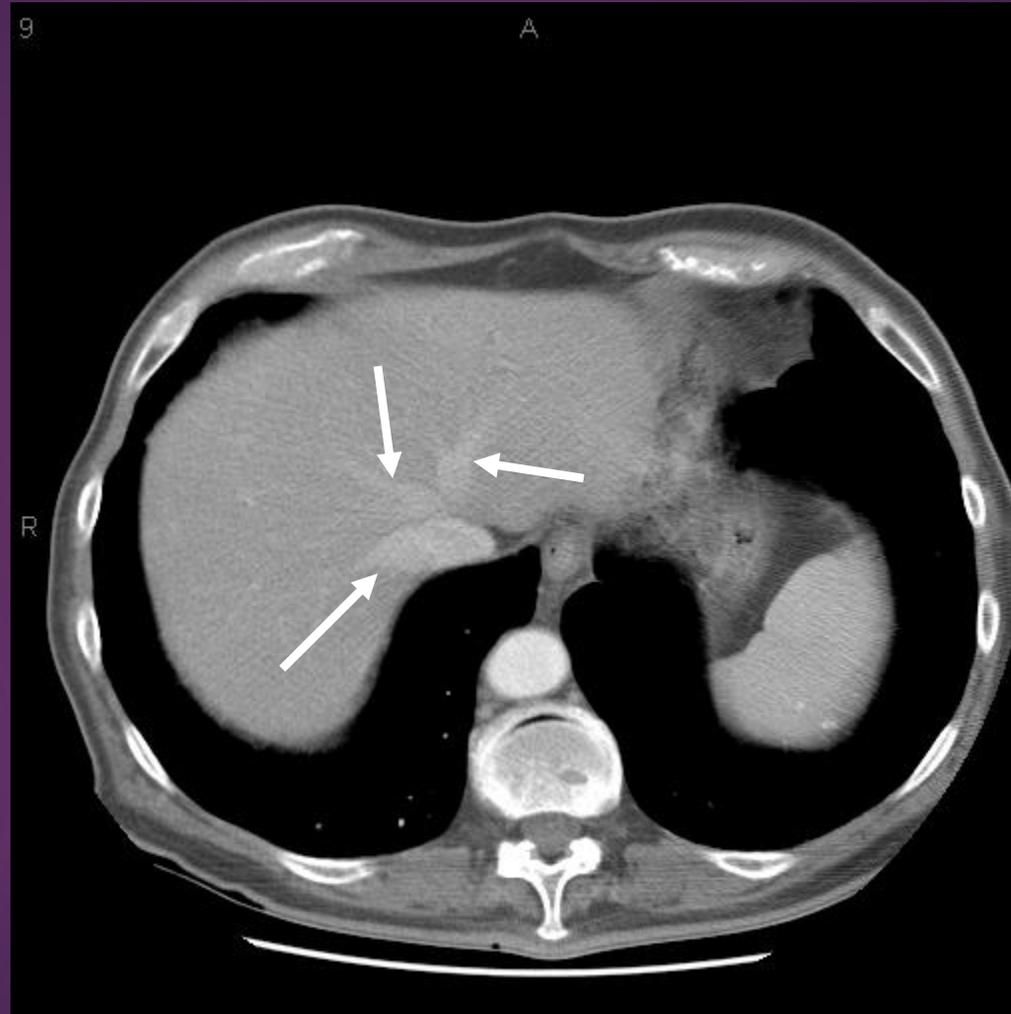






**What is this contrast containing structure posterior to the liver?**

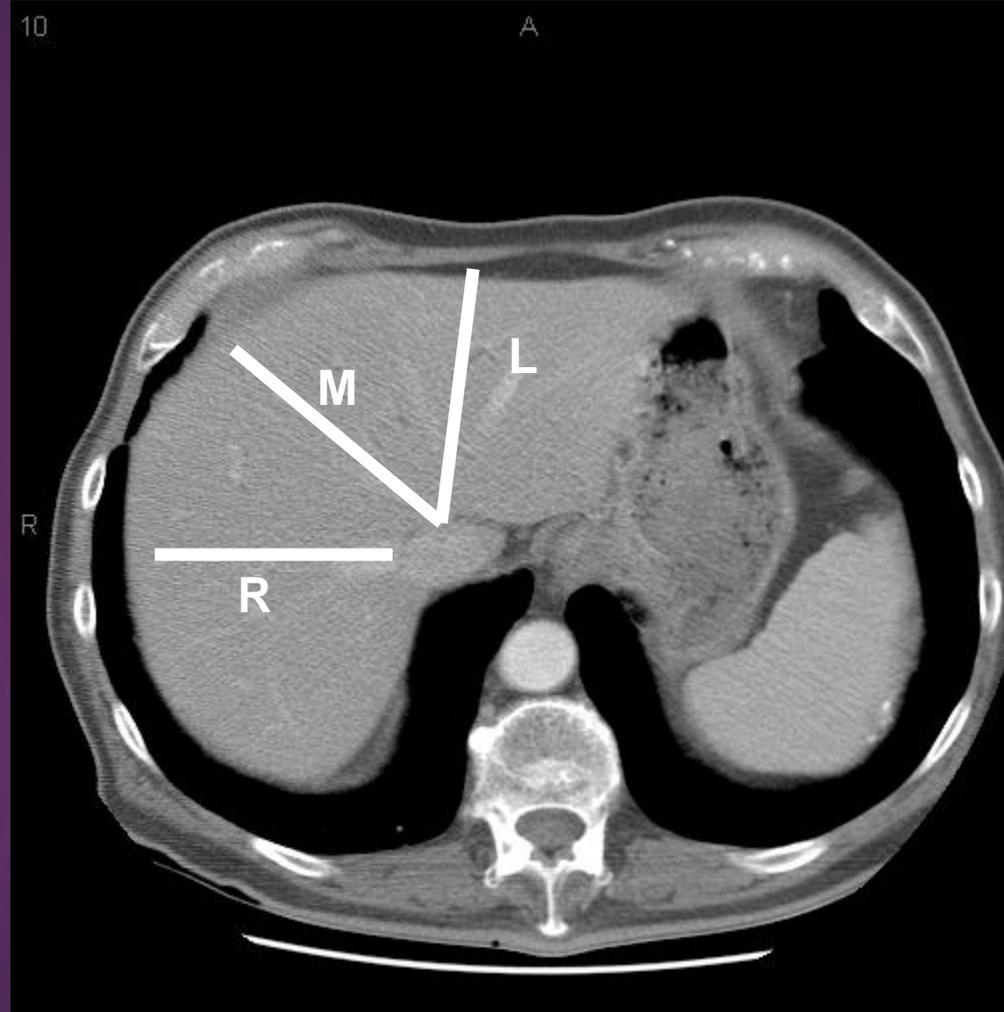
**IVC**



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

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

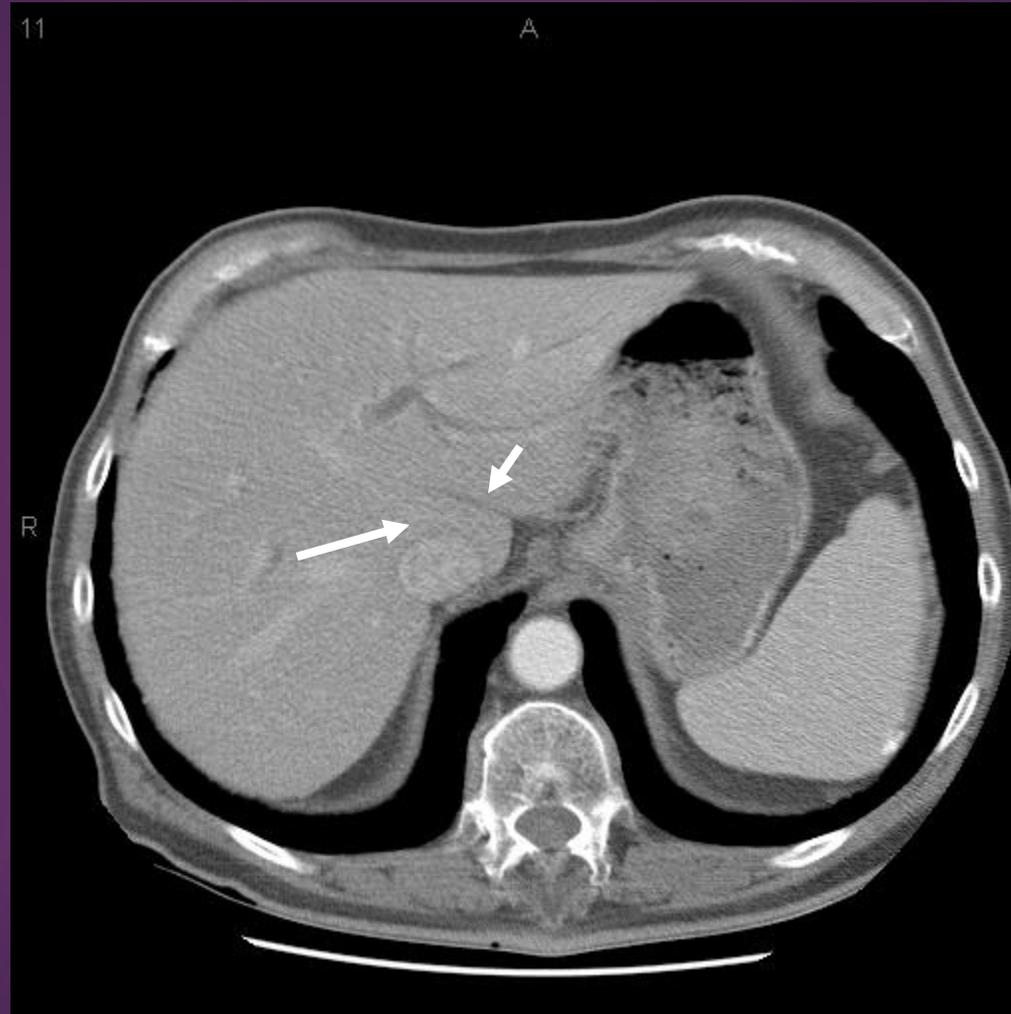
**What anatomically divides the liver into lobes (right and left) and segments.**



**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.**

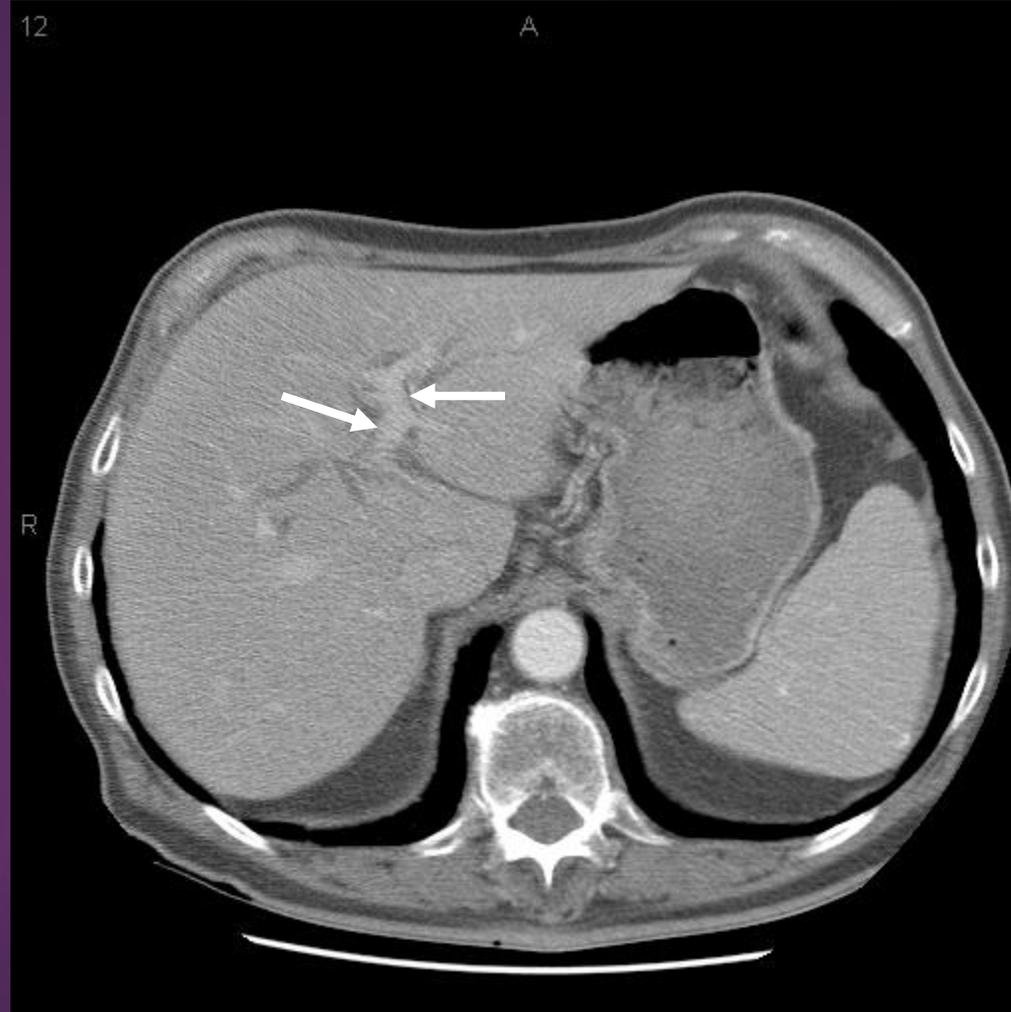
What lobe of the liver is marked with the arrow

The caudate lobe



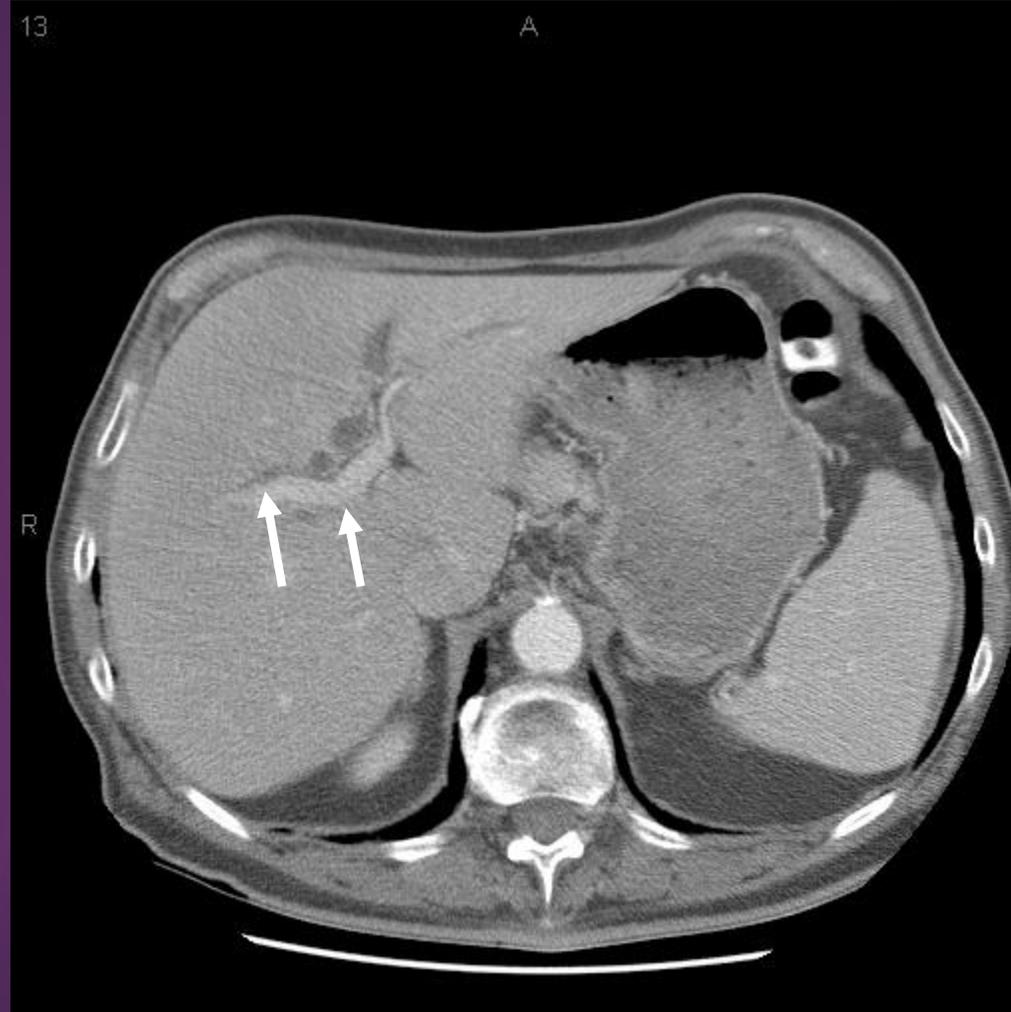
Can you identify the bright structure surrounded by the black arrows?

This is the left portal vein



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

This is the right portal vein





**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?

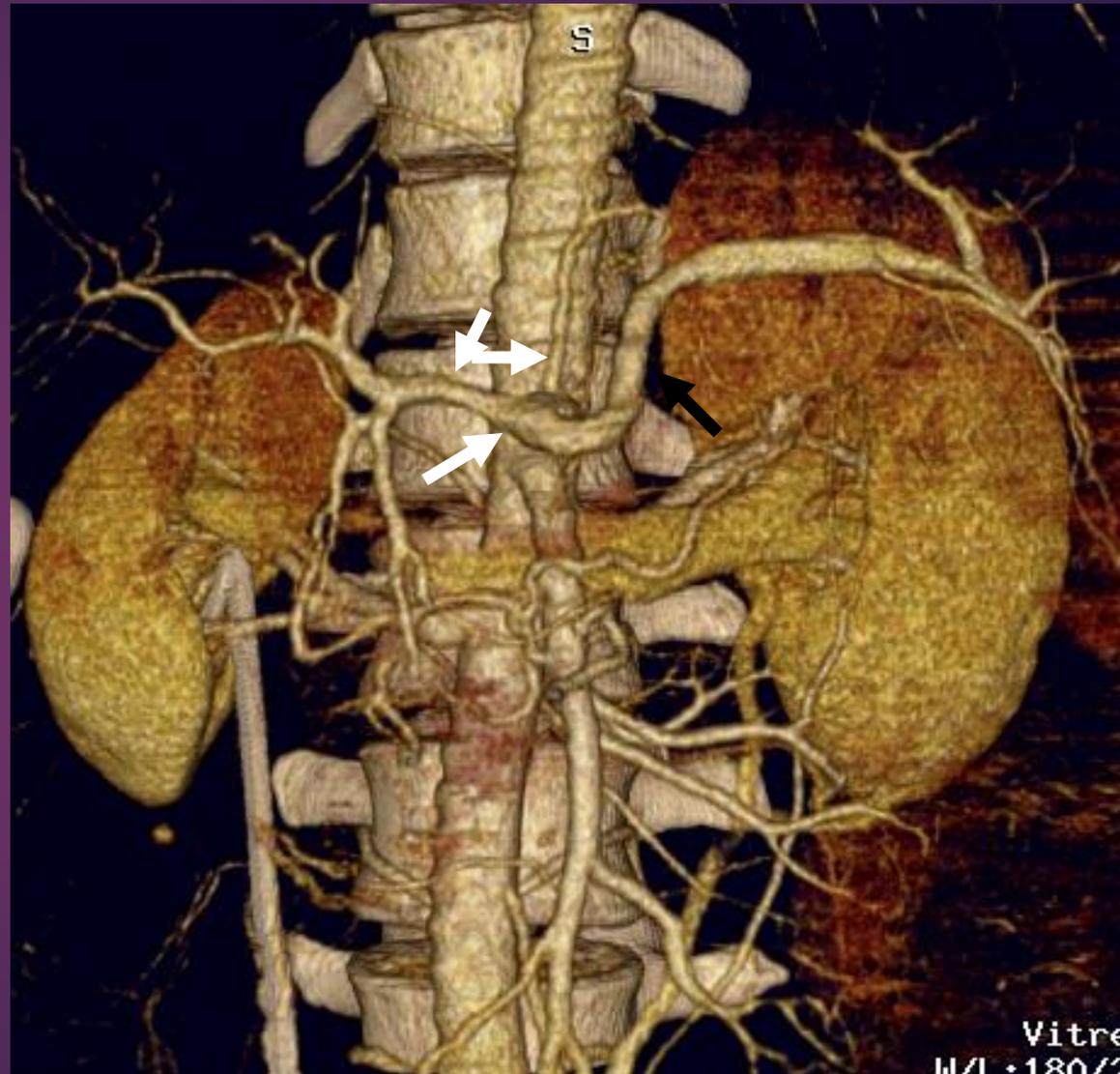
Can you see the 3 branches: common hepatic, splenic and left gastric?

Celiac trunk

Splenic artery

Common hepatic

Left gastric



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

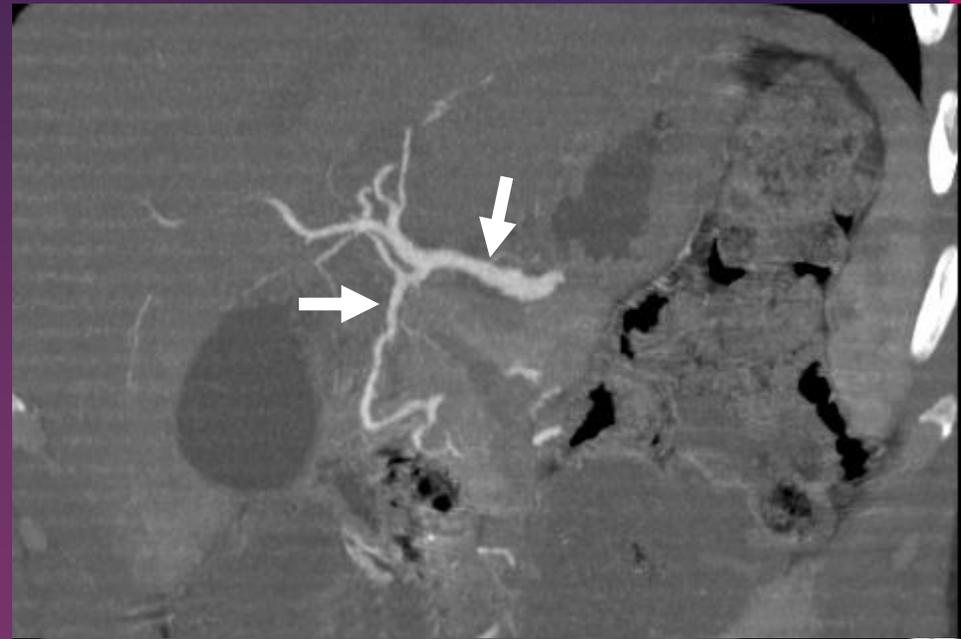
This is the common hepatic artery off the celiac trunk.

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 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

Hint: does this person have a gallbladder?

These are clips from a cholecystectomy

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?**



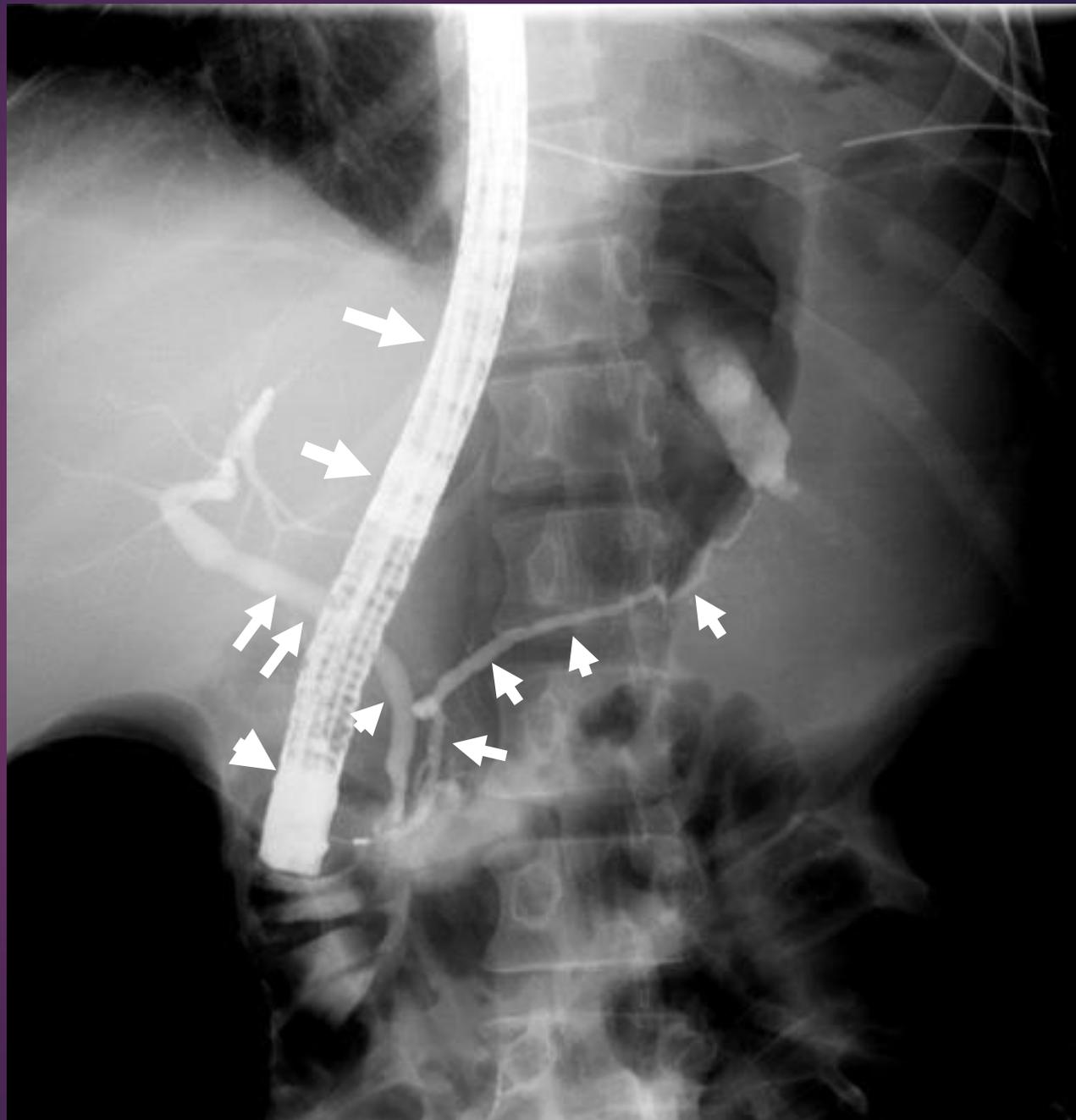
**This is an ERCP on a different patient. Can you find the common bile duct?**

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

**Can you find the pancreatic duct?**

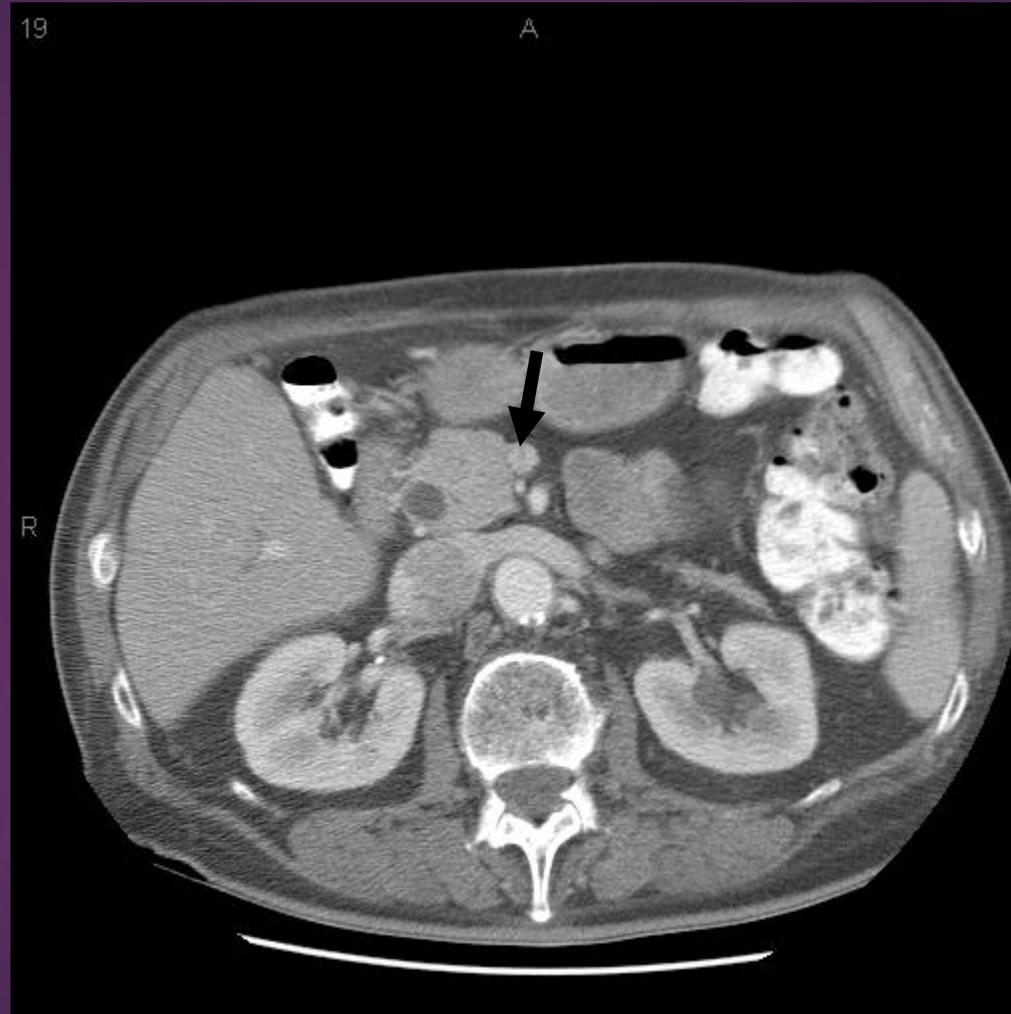
**What is this large structure?**

**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?**

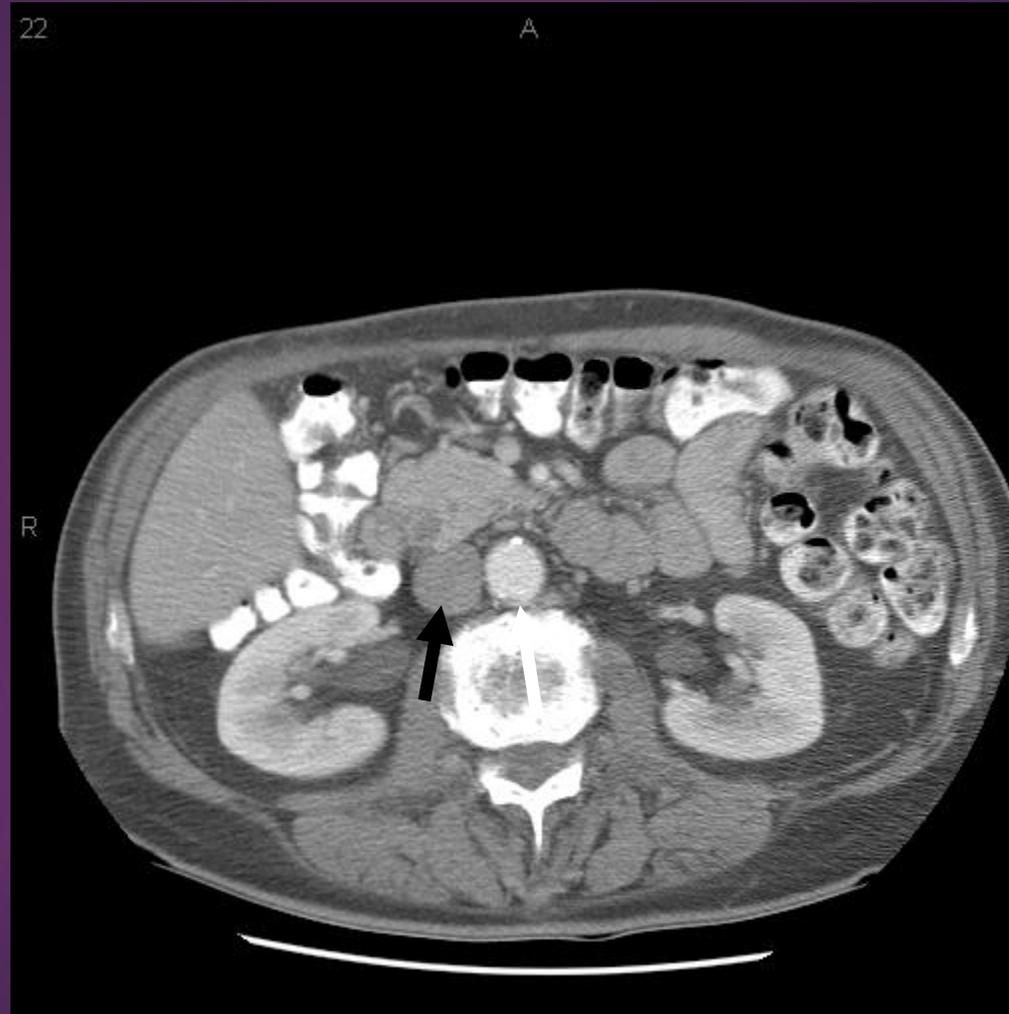
**Pancreatic duct**

**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



R



27

A



# 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

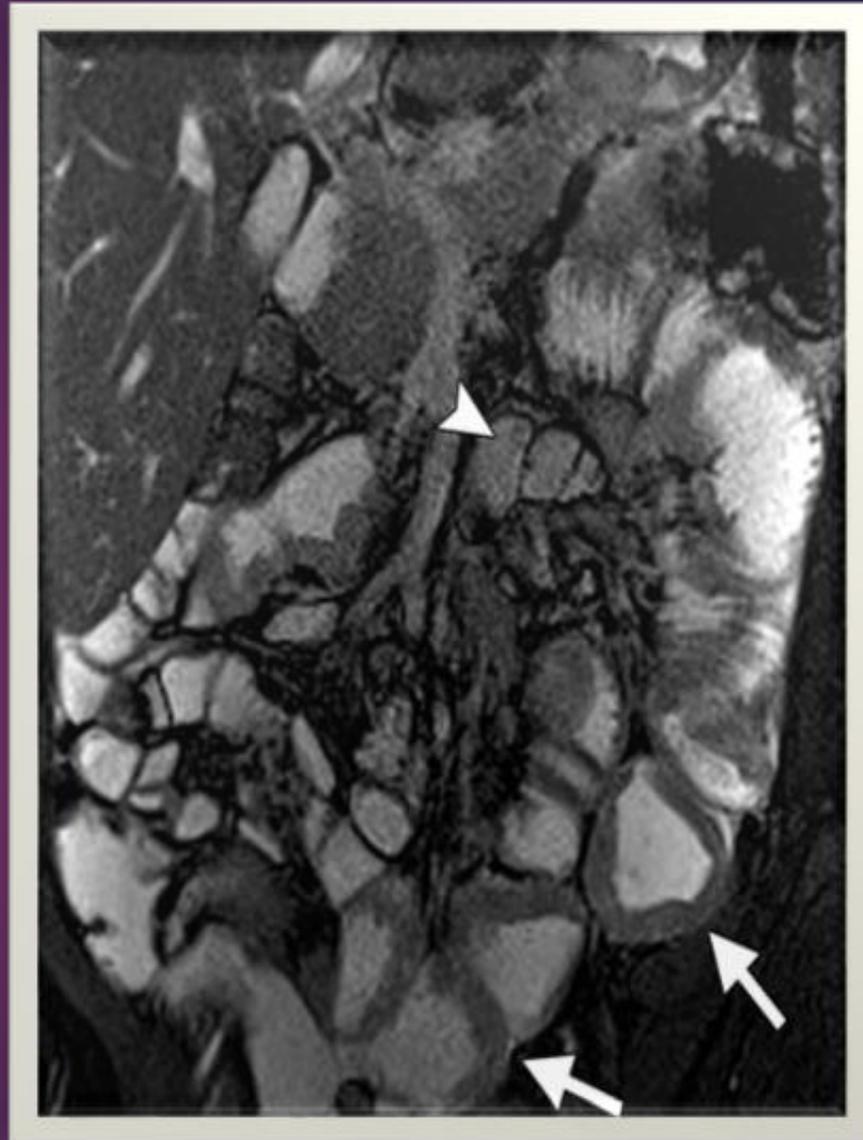
- Abdominal **solid** organ masses
- Inflammatory bowel disease

## ❖ 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!