Chair of propaedeutics of internal medicine with care of patients

INSTRUMENTAL METHODS OF RESEARCH OF THE GASTROINTESTINAL TRACT AND KIDNEYS

The instrumental methods of examination in gastroenterology.

- endoscopy
  - esophagoscopy
  - gastroscopy
  - colonoscopy
  - rectoromanoscopy
- roentgenography
  - contrast study of gastrointestinal system
  - birrigoscopy and irrigography
  - cholecystography
- angiography
- radioisotope indication
- computed tomography,
- magnetic resonans imaging
- ultrasound scanning
- intragastric pH-metry
- laparoscopy

Endoscopy can involve

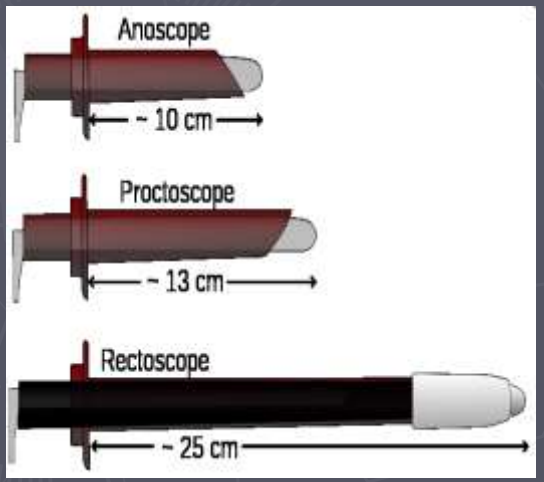
- esophagus, stomach and duodenum (esophagogastroduodenoscopy)
- small intestine (enteroscopy)
- large intestine/colon (colonoscopy, sigmoidoscopy)
- bile duct
- endoscopic retrograde cholangiopancreatography (ERCP)
- duodenoscope-assisted cholangiopancreatoscopy,
- intraoperative cholangioscopy
- anoscopy, proctoscopy, and rectoscopy

Endoscope

- Optic fiber system to carry light to the tip of the endoscope
- A chip camera at the tip of the endoscope - this has now replaced the optic fibers of older scopes that were prone to damage and consequent loss of picture quality
- Irrigation channel to clean the lens
- Suction/Insufflation/Working channels - these may be in the form of one or more channels
- Control handle - this houses the controls

Risks

- Infection
- Punctured organs
- Over-sedation
- Hole in the colon



Biopsy

- Biopsy is a very valuable adjunct to endoscopy.
- Small biopsies can be made with a pincer which is passed through the scope and allows sampling of 1 to 3 mm pieces of tissue under direct vision.
- Biopsy allows the pathologist to render an opinion on later histological examination of the biopsy tissue with light microscopy and immunohistochemistry.
- Biopsied material can also be tested on urease to identify Helicobacter pylori.

Esophagogastroduodenoscopy

- Normal mucosa of stomach

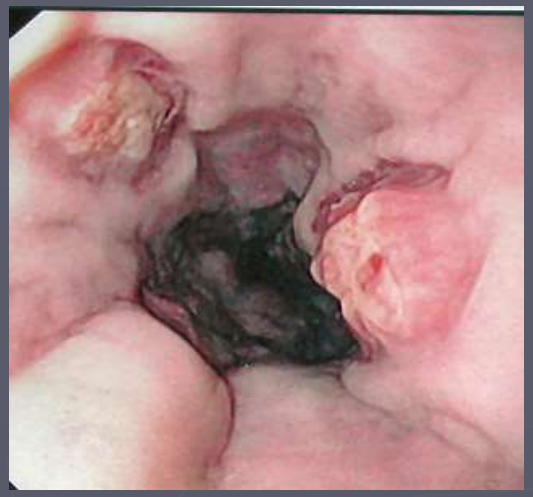
- Acute gastritis

- Chronic not-atrophic gastritis

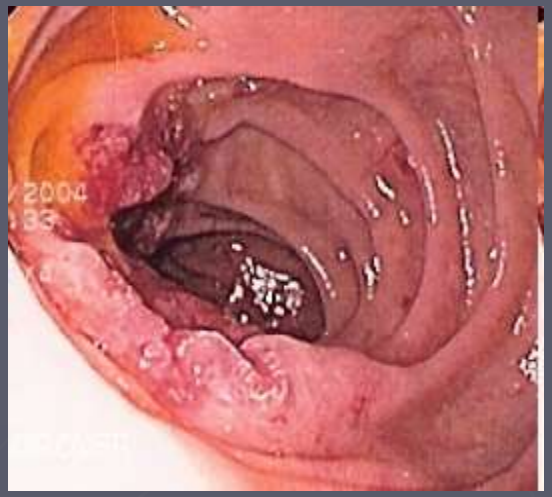
- Atrophic gastritis

- Autoimmune gastritis

- Hypertrophic gastritis

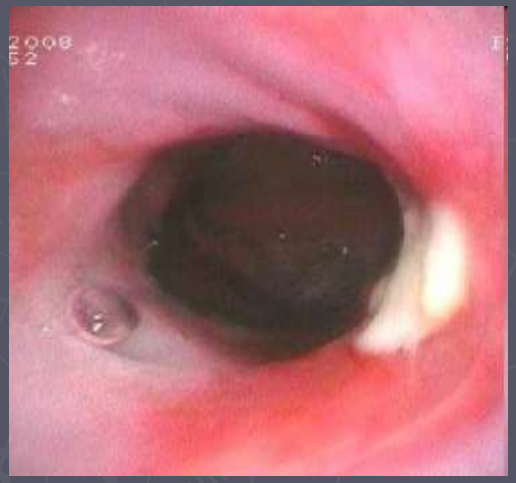


- Esophageal ulcers seen after banding of esophageal varices.

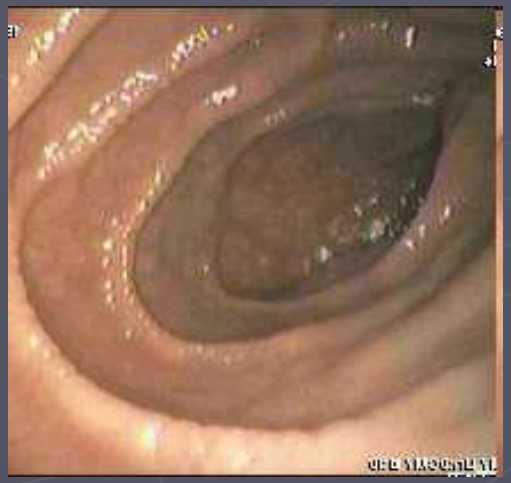


- Adenocarcinoma seen in the post-bulbar duodenum.

- Barrett's esophagus, The area of red mucosa.



- Esophageal ulcer and Barrett's esophagus.



- Duodenum. Celiac disease (scalloping of folds).

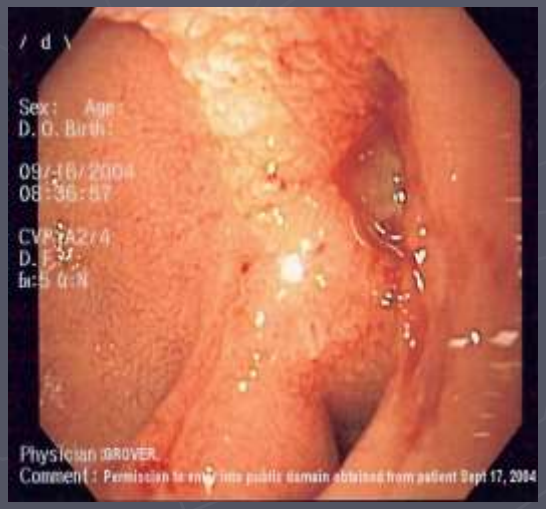
- Gastric ulcer.

- Gastric antral vascular ectasia (radial pattern around the pylorus)

- Deep gastric ulcer

- Gastric ulcer in antrum of stomach with overlying clot

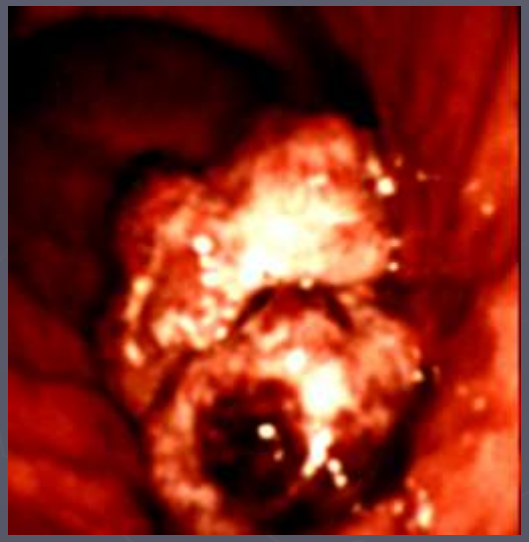
- Gastric polyp

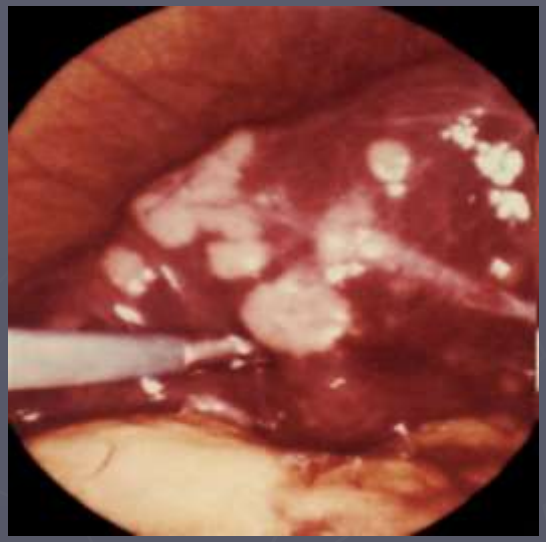


- Endoscopic image of a posterior wall duodenal ulcer with a clean base

- Gastric polyp

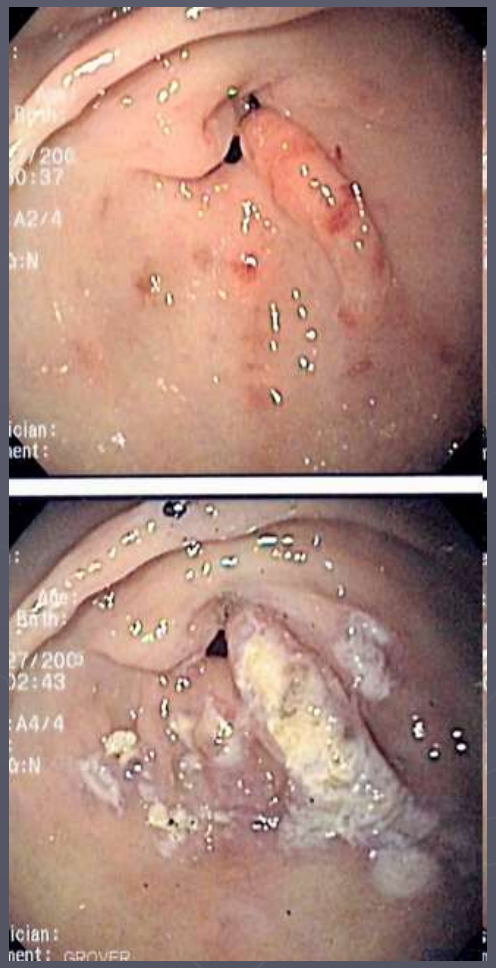
Endoscopic images of cancer of stomach





Treatment

- BIB (Bioenterics Intragastric ballon)



- Ulcer clips

- Ulcer seen after endoscopic clipping

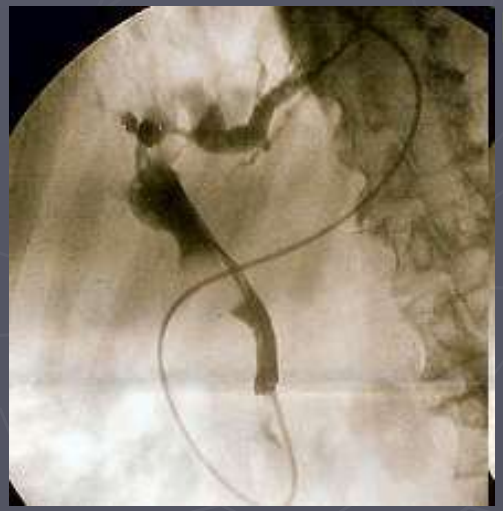
- Polypectomia

- Endoscopic image of gastric antral vascular ectasia seen as a radial pattern around the pylorus before (1) and after (2) treatment with argon plasma coagulation

Endoscopic retrograde cholangiopancreatography (ERCP)

- Stones in bile duct

- Duodenoscopic image of two pigment stones extracted from common bile duct after sphincterotomy.



- Fluoroscopic image of common bile duct stone seen at the time of ERCP. The stone is impacted in the distal common bile duct. A nasobiliary tube has been inserted.

Colonoscopy

- Colonoscopy is the endoscopic examination of the colon and the distal part of the small bowel with a CCD camera or a fiber optic camera on a flexible tube passed through the anus.

- It may provide a visual diagnosis (ulceration, polyps) and grants the opportunity for biopsy or removal of suspected lesions.

- Sigmoidoscopy only examines up to the sigmoid, the most distal part of the colon, while colonoscopy examines the whole large bowel.

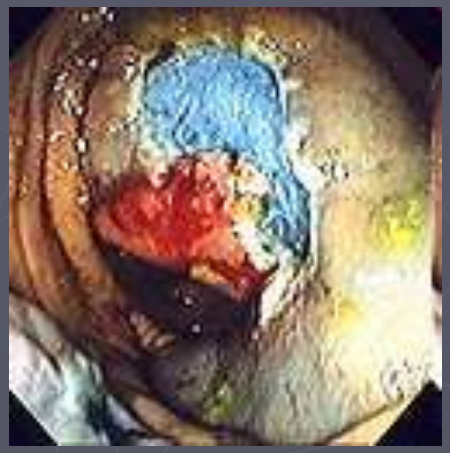
Preparation

- The colon must be free of solid matter for the test to be performed properly.
- For one to three days, the patient is required to follow a low fiber or clear-liquid only diet.
- The day before the colonoscopy, the patient is either given a laxative preparation (such as Bisacodyl, phospho soda, sodium picosulfate, or sodium phosphate and/or magnesium citrate) and large quantities of fluid, or whole bowel irrigation is performed using a solution of polyethylene glycol and electrolytes.

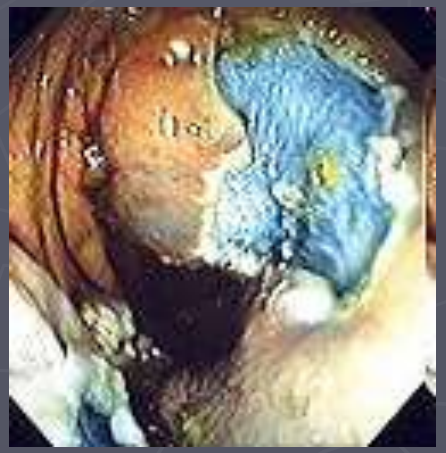
Colonoscopyc images

- Polyp is identified

- A sterile solution is injected under the polyp to lift it away from deeper tissues



- A portion of the polyp is now removed.



- The polyp is fully removed.

Capsule Endoscopy

- A new endoscopy technology using a Magnetically Guided Capsule Endoscope (MGCE) for wireless control, monitor and imaging →

- The researchers noted that MGCE technique provided accurate endoscopic examinations in a more patient-friendly manner and with no need for using sedatives.
- The magnetically guided capsule system provides reliable results for gastrointestinal endoscopic examinations compared to conventional endoscopy.
- The capsule enables much less invasive stomach examinations. It means an enormous boost in acceptability for the patient.

Diagnostic radiography

- Diagnostic radiography involves the use of both ionising radiation and non-ionising radiation to create images for medical diagnoses.
- The abdominal x-ray is a test that can be carried out quickly and easily in an emergency department.
- The test can help diagnose some abdominal conditions. It is not a useful investigation for most abdominal conditions.
- Small and large bowel obstructions, volvulus and malrotations can be diagnosed by AXR.

Upper gastrointestinal series

- Upper GI series, also upper gastrointestinal (GI) tract radiography, is a radiologic examination of the upper gastrointestinal tract. It consists of a series of X-ray images of the esophagus, stomach and duodenum.
- The most common use for this medical testing is to look for signs of ulcers, acid reflux disease, uncontrollable vomiting, or unexplained blood in the stools (hematochezia or positive fecal occult blood).

Upper gastrointestinal series

- In the X-ray room, the patient is given two medications to drink that help improve the quality of the resulting X-rays.
- The patient may also be administered glucagon, a pancreatic hormone that is injected intravenously.
- The first drink is very carbonated, made from baking-soda crystals which expands the stomach by causing gas to build in the stomach.
- The second drink is a contrast agent, typically a thick, chalky liquid containing a barium salt.

(This test is sometimes called a barium swallow.)

- The barium outlines the stomach on the X-rays, helping the doctor find tumors or other abnormal areas.

Upper GI series (barium swallow) of the esophagus, showing abnormalities associated with eosinophilic esophagitis.

- The doctors usually take a series of pictures to capture different poses and views of the digestive system.
- During the test, the doctor may pump air into the stomach to make features such as small tumors easier to see.

- Figures showing a grossly distended stomach

- A small bowel follow-through, (also called small bowel series,) is a radiologic examination of the small intestine from the distal duodenum/duodenojejunal junction to the ileocecal valve.

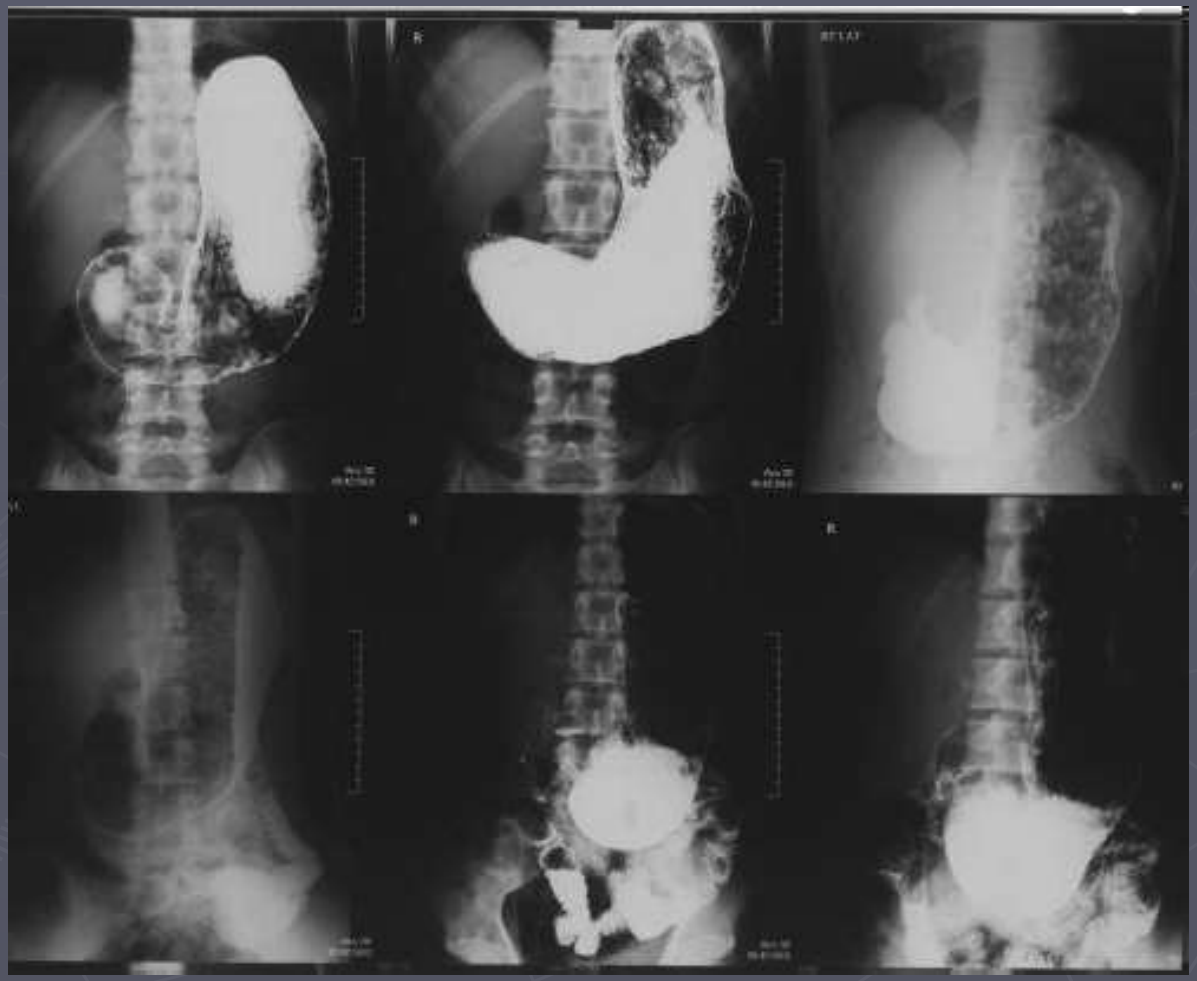
- An X-ray examination of the most proximal small bowel (duodenum) is typically done together with an examination of the esophagus and stomach and (upper GI series).

A small bowel follow-through

- The patient drinks a contrast medium containing barium sulfate.
- This contrast medium appears white on x-rays, and shows the outline of the internal lining of the bowel.
- X-ray images are taken as the contrast moves through the intestine, commonly at 0 minutes, 20 minutes, 40 minutes and 90 minutes.
- The test is completed when the Barium is visualised in the terminal ileum and Caecum, which marks the beginning of the large bowel. This is one of the most common places for pathology of the bowel to be found, therefore imaging of this structure is crucial.
- The test length varies from patient to patient as bowel motility is highly variable.
- The barium is non-toxic and passed out normally as a stool, although the appearance may be paler than usual.

- Remaining barium in the small bowel and the caecum 3 days after the barium follow-through

Barium follow through x-ray



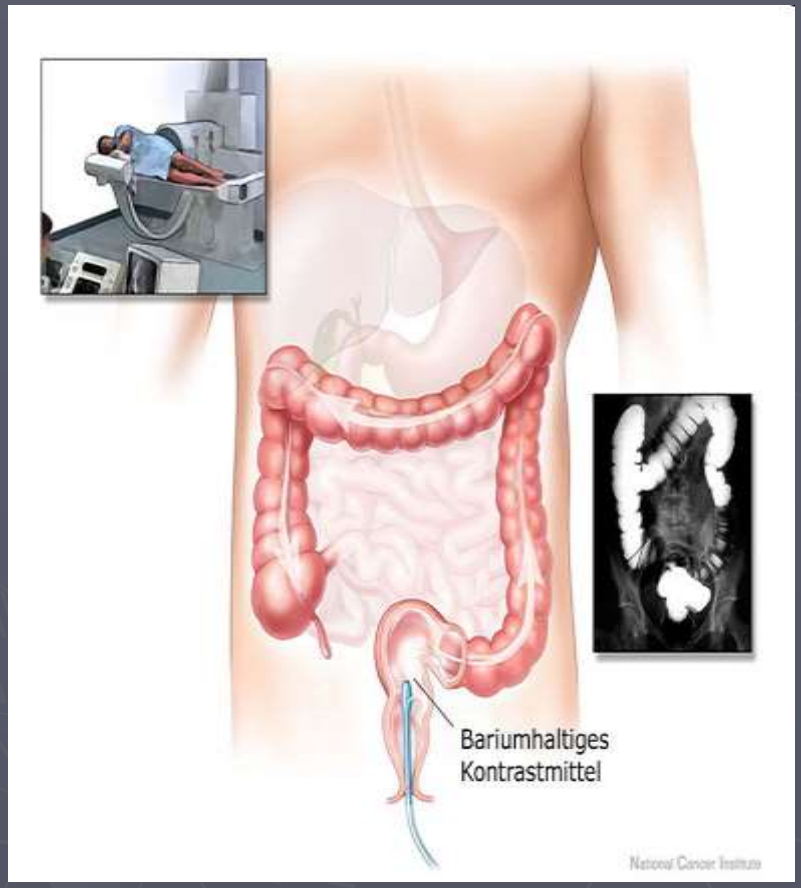
Barium follow through x-ray

GI barium contrast x-ray

- Barium follow through x-ray

- Recurrent colon carcinoma, enterocolic fistula, barium small bowel follow through, 10 minutes

Barium Enema



- A lower gastrointestinal series, also called a barium enema, is a medical procedure used to examine and diagnose problems with the human colon (large intestine). X-ray pictures are taken while barium sulfate fills the colon via the rectum.

- Thorough cleaning of the large intestine is necessary for accurate pictures. Test preparations include a clear liquid diet, drinking a bottle of magnesium citrate (a laxative), and warm water enemas to clear out any stool particles.

Barium Enema

- This test may be done in a hospital or clinic.
- The patient lies on the X-ray table and a preliminary X-ray is taken.
- The patient is then asked to lie on the side while a well lubricated enema tube is inserted into the rectum.
- As the enema enters the body, the patient might have the sensation that their stomach is being filled.
- The barium sulfate, a radiopaque (shows up on X-ray) contrast medium, is then allowed to flow into the colon.
- A small balloon at the tip of the enema tube may be inflated to help keep the barium sulfate inside.
- The flow of the barium sulfate is monitored by the health care provider on an X-ray fluoroscope screen (like a TV monitor).

- Air may be puffed into the colon to distend it and provide better images (often called a "double-contrast" exam).
- If air is used, the enema tube will be reinserted) and a small amount of air will be introduced into the colon, and more X-ray pictures are taken.
- The patient is usually asked to move to different positions and the table is slightly tipped to get different views.
- If there is a suspected bowel perforation, a water-soluble contrast is used instead of barium. The procedure is otherwise very similar, although the images are not quite as good.

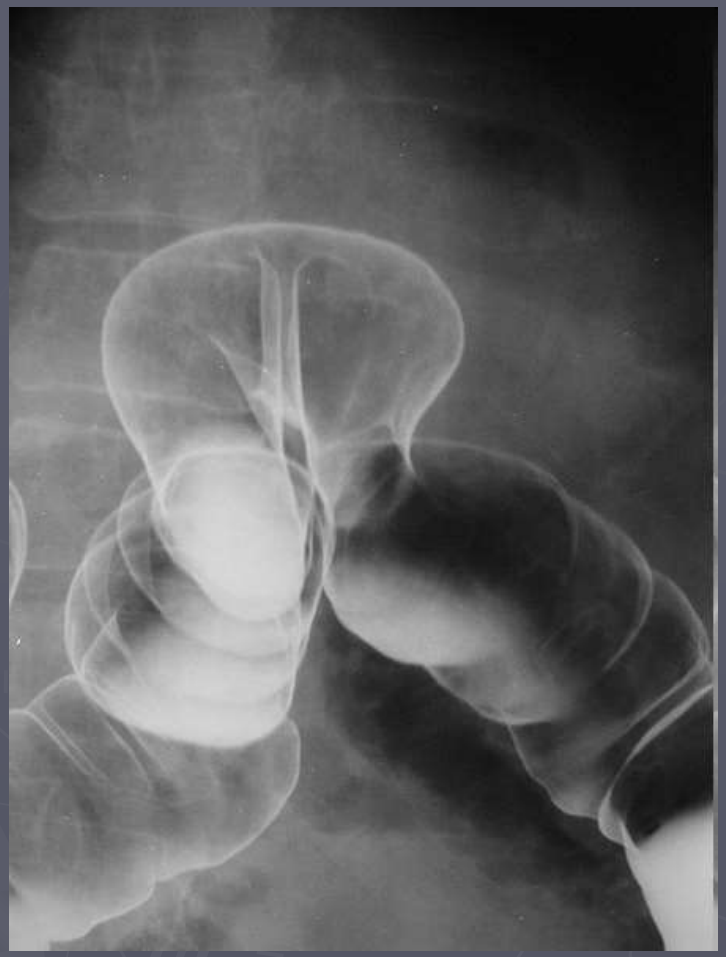
  - (The concern with existing perforation is that contrast will leak from the bowel to the peritoneal cavity, and water-soluble material, compared to barium is less obscuring at laparotomy.)

Barium Enema

- In a healthy colon, barium should fill the colon uniformly and show normal bowel contour, patency (should be freely open), and position.
- colonic herniation.
- ulcerative colitis
- Crohn's disease.
- polyps
- diverticulosis
- intussusception
- appendicitis
- irritable bowel syndrome (IBS)

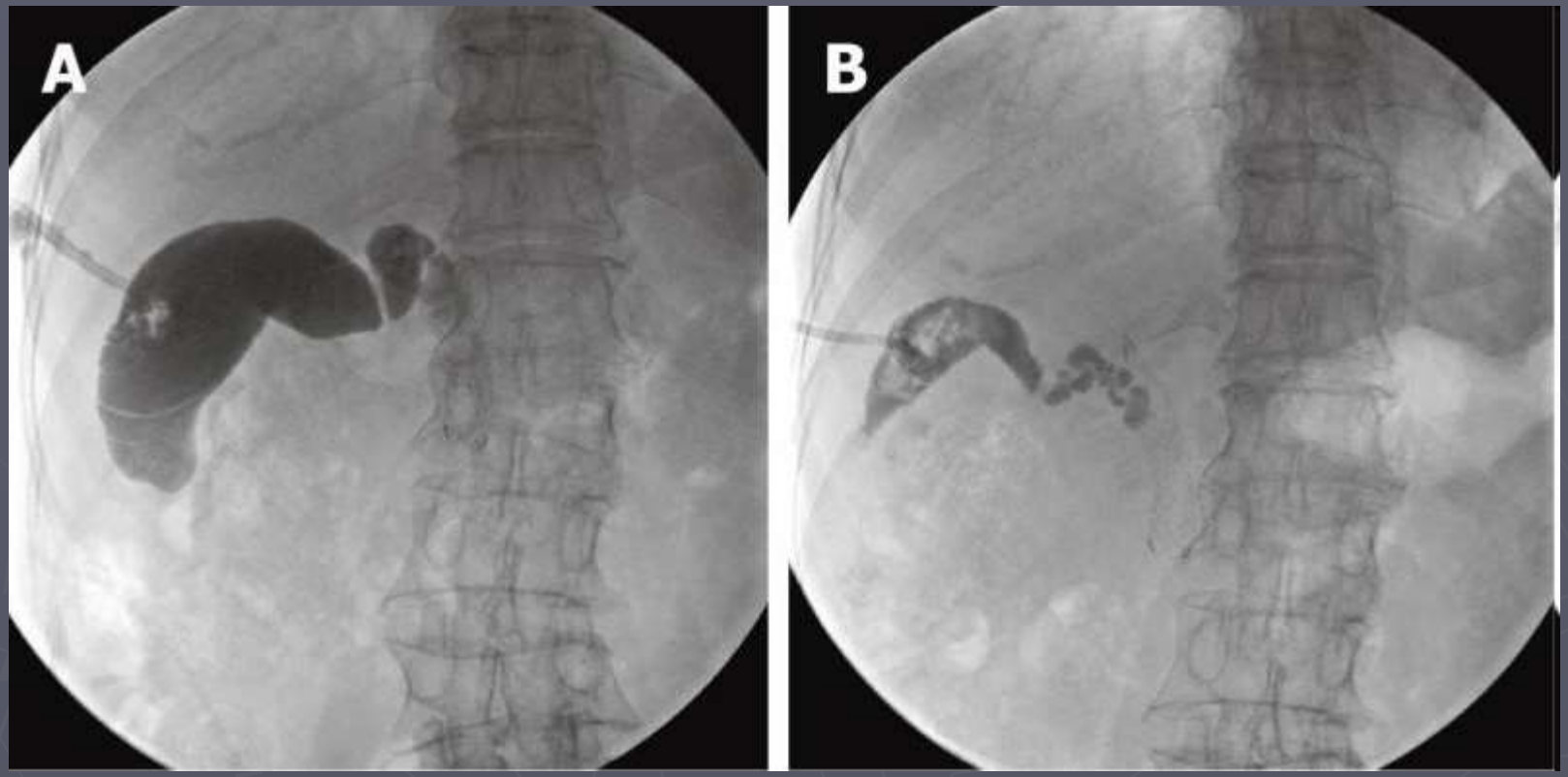
Additional conditions under which the test may be performed:

- CMV gastroenteritis/colitis
- Hirschsprung's disease
- intestinal obstruction
- intussusception (children)



Barium Enema

Cholecystography



- Oral cholecystography is a procedure used to visualize the gallbladder by administering, by mouth, a radiopaque compound that is excreted by the liver. This excreted material will be concentrated in the gallbladder, which extracts water, thus concentrating the excreted substance. With the substance in the gallbladder, an abdominal film can be performed.

Sonography (ultrasonography)

- Sonography (ultrasonography) is widely used in medicine. It is possible to perform both diagnosis and therapeutic procedures, using ultrasound to guide interventional procedures (for instance biopsies or drainage of fluid collections).
- Sonographers are medical professionals who perform scans for diagnostic purposes.
- Sonographers typically use a hand-held probe (called a transducer) that is placed directly on and moved over the patient.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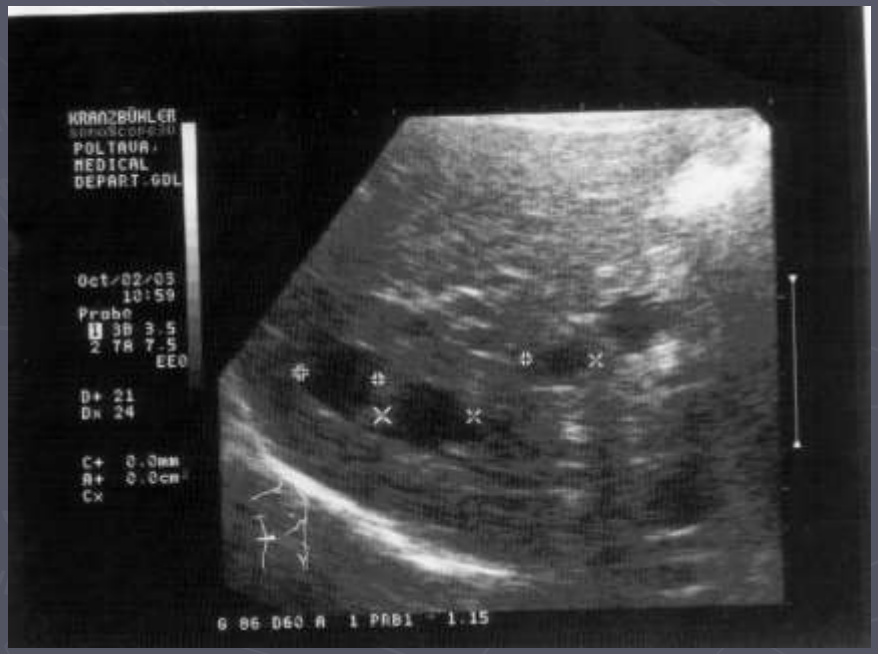
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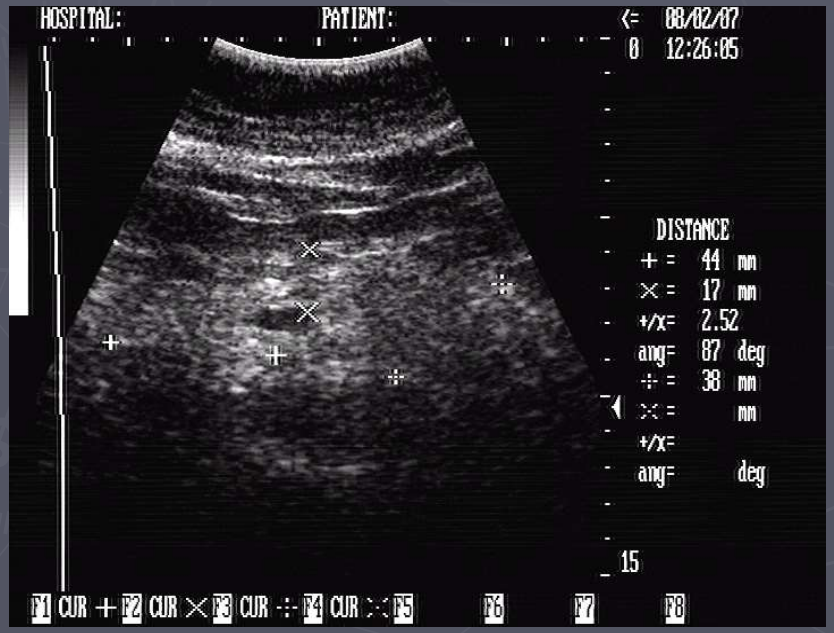
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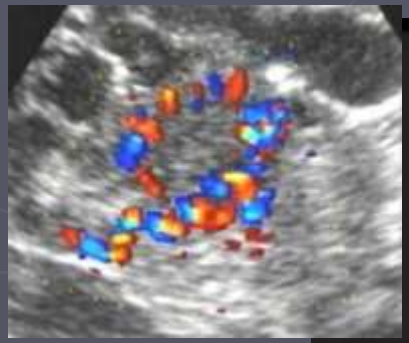
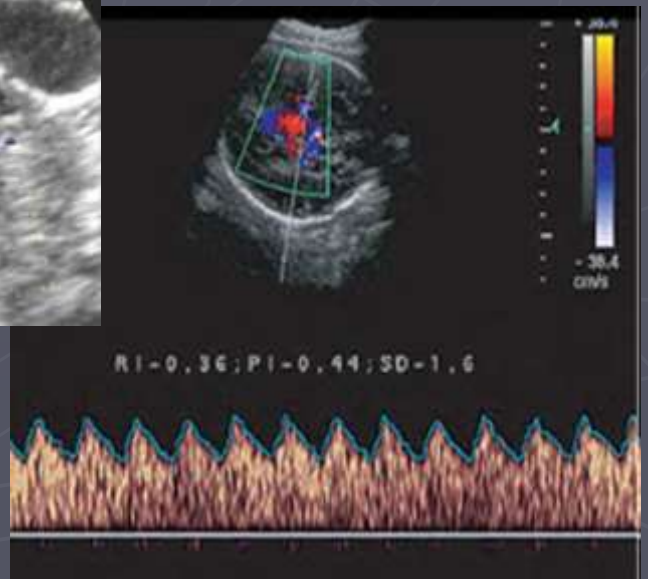
Dopplersonography





Methods of investigation of kidneys

- An intravenous pyelogram
- Ultrasonic scanning
- Angiography
- CT angiography
- MR angiography
- Digital subtraction angiography (DSA)
- Computed tomography
- Magnetic resonance imaging (MRI)
- Scintigraphy ("scint")
- SPECT
- Positron emission tomography (PET)

Ultrasonic scanning

An intravenous pyelogram

- An intravenous pyelogram (also known as IVP, pyelography, intravenous urogram or IVU) is a radiological procedure used to visualize abnormalities of the urinary system, including the kidneys, ureters, and bladder.

- plain KUB or Abdominal x-ray;
- an injection of contrast media, typically 50 ml;
- delayed Abdominal x-ray, taken at roughly 15 minutes post injection.

Diagnoses

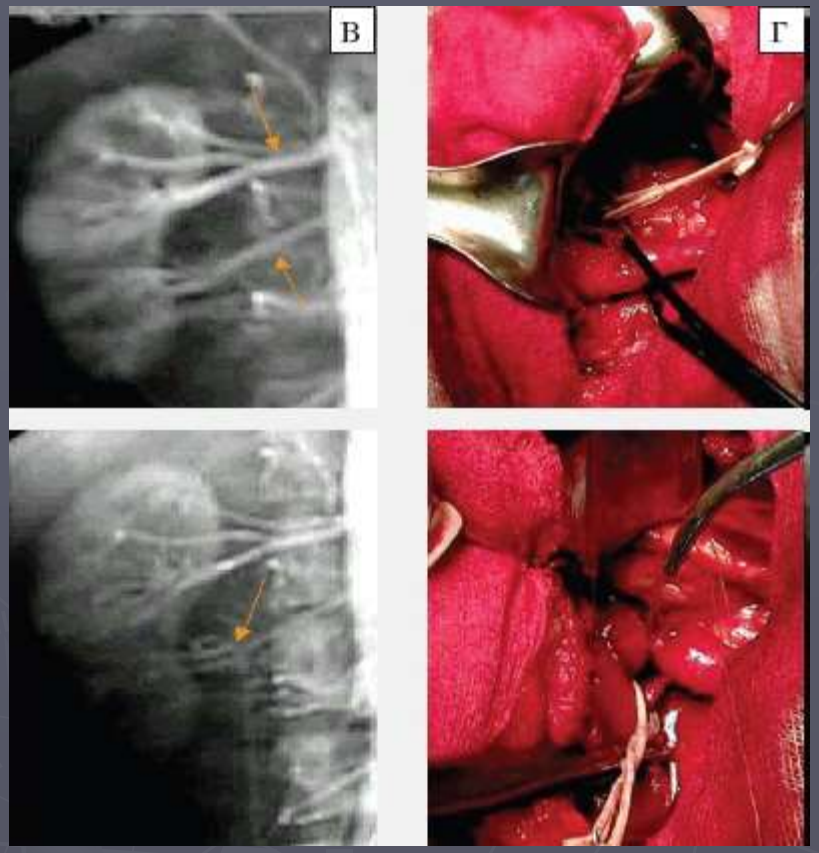
- Chronic Pyelonephritis
- Kidney stones
- Renal cell carcinoma or RCC
- Transitional cell carcinoma, or TCC
- Polycystic kidneys
- Anatomical variations, i.e. horseshoe kidney or a duplex collecting system
- Obstruction (commonly at the pelvic-ureteric junction or PUJ and the vesicoureteric junction or VUJ)

Angiography

- Angiography or arteriography is a medical imaging technique used to visualize the inside, or lumen, of blood vessels and organs of the body, with particular interest in the arteries, veins and the heart chambers. This is traditionally done by injecting a radio-opaque contrast agent into the blood vessel and imaging using X-ray based techniques such as fluoroscopy. The word itself comes from the Greek words angeion, "vessel", and graphein, "to write or record". The film or image of the blood vessels is called an angiograph, or more commonly, an angiogram.

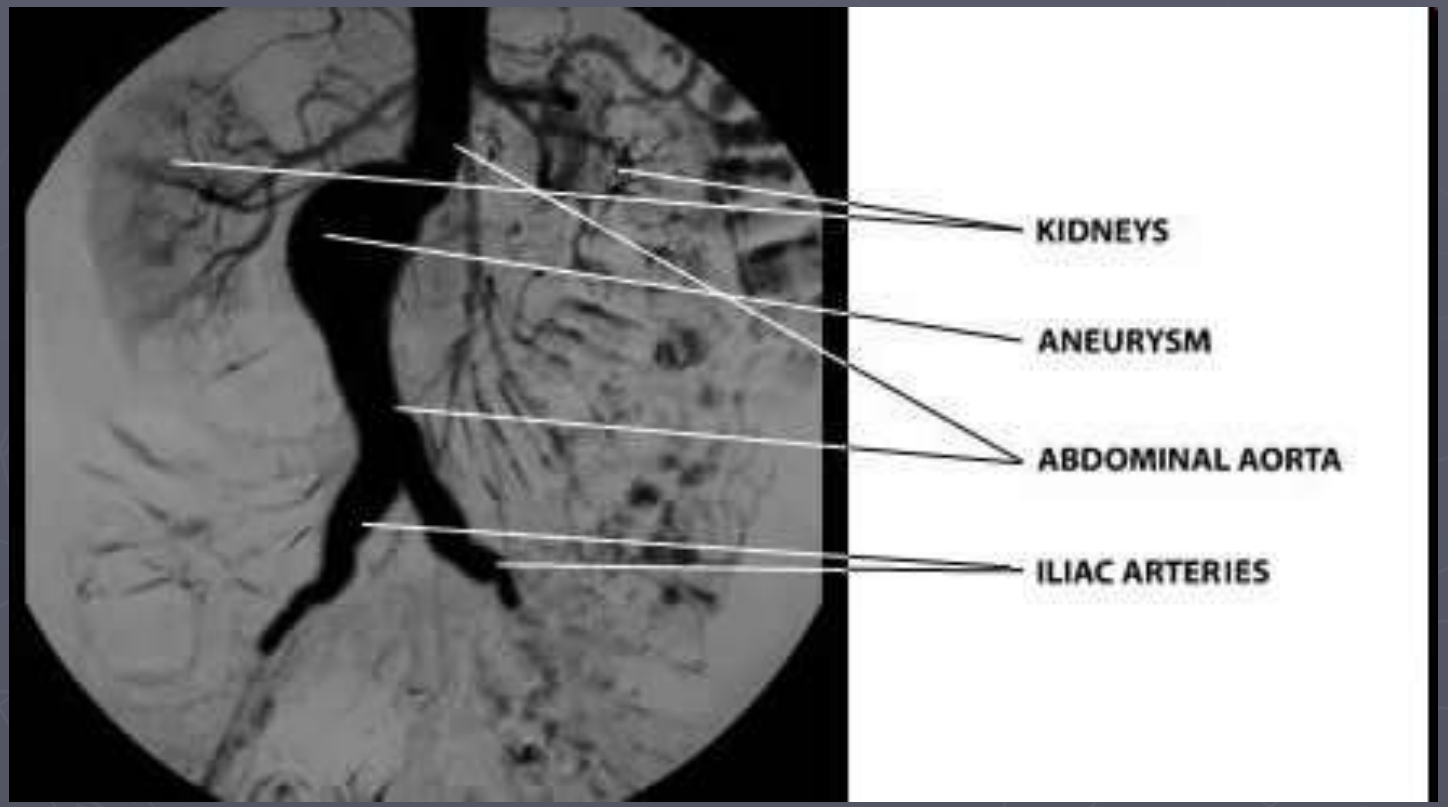
- The term angiography is strictly defined as based on projectional radiography; however, the term has been applied to newer vascular imaging techniques such as CT angiography and MR angiography. The term isotope angiography has also been used, although this more correctly is referred to as isotope perfusion scanning.

Angiography



- Angiogramms of artery of kidney

Angiography



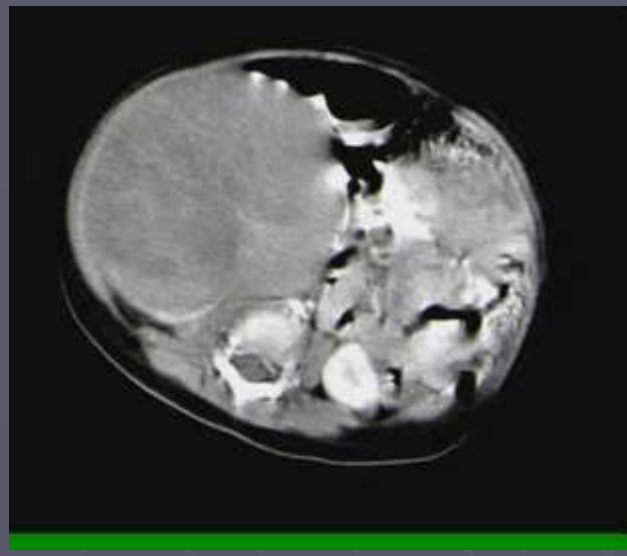
CT angiography

- Patent left leg runoff seen on multidetector CT (MDCT) angiography but not on digital subtraction angiography (DSA) in 74-year-old man with severe short-distance claudication. Posteroanterior DSA image obtained from right brachial approach of abdominal aorta shows severe irregularity of aorta.

MR angiography

Digital subtraction angiography (DSA)

Computed tomography



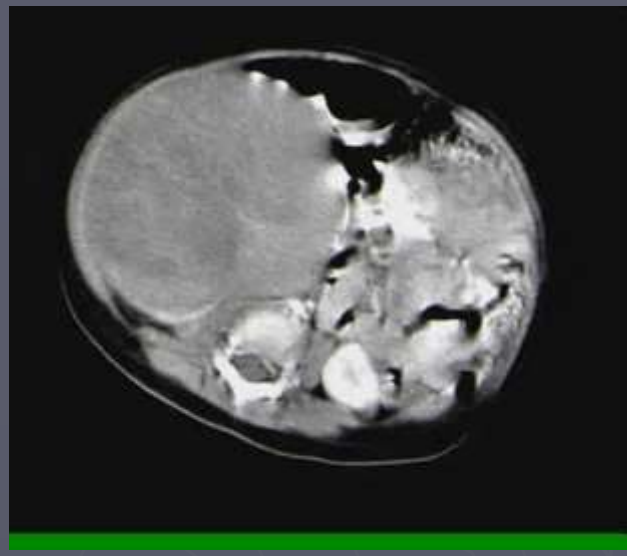
Computed tomography or CT scan (previously known as CAT scan, the "A" standing for "axial") uses a high amount of ionizing radiation (in the form of X-rays) in conjunction with a computer to create images of both soft and hard tissues. These images look as though the patient was sliced like bread (thus, "tomography"-- "tomo" means "slice"). The machine looks similar to an MRI machine to many patients, but is not related. The exams are generally short, most lasting only as long as a breath-hold. Contrast agents are often used, depending on the tissues needing to be seen. Radiographers perform these examinations, sometimes in conjunction with a radiologist (for instance, when a radiologist performs a CT-guided biopsy).

Computed tomography

- CT is a sensitive method for diagnosis of abdominal diseases.
- It is used frequently to determine stage of cancer and to follow progress.
- It is also a useful test to investigate acute abdominal pain (especially of the lower quadrants, whereas ultrasound is the preferred first line investigation for right upper quadrant pain).
- Renal stones, appendicitis, pancreatitis, diverticulitis, abdominal aortic aneurysm, and bowel obstruction are conditions that are readily diagnosed and assessed with CT.
- CT is also the first line for detecting solid organ injury after trauma.

- Three-dimensional reconstructed CT scan image of a ureteral stent in the left kidney (indicated by yellow arrow). There is a kidney stone in the pyelum of the lower pole of the kidney (highest red arrow) and one in the ureter beside the stent (lower red arrow).

Magnetic resonance imaging (MRI)

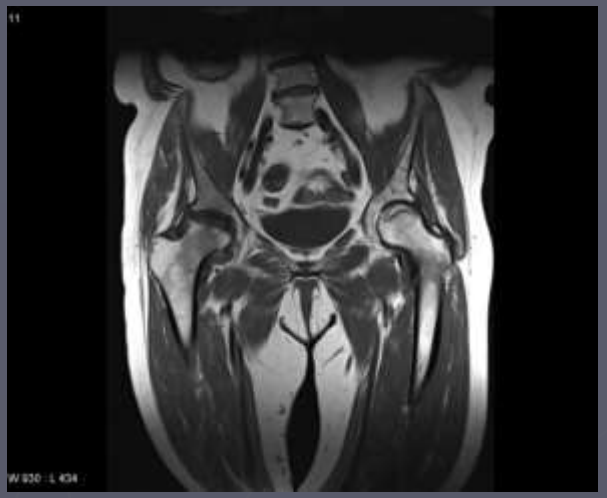


A magnetic resonance imaging instrument (MRI scanner), or "nuclear magnetic resonance (NMR) imaging" scanner as it was originally known, uses powerful magnets to polarise and excite hydrogen nuclei (single proton) in water molecules in human tissue, producing a detectable signal which is spatially encoded, resulting in images of the body.

Because CT and MRI are sensitive to different tissue properties, the appearance of the images obtained with the two techniques differ markedly.

In CT, X-rays must be blocked by some form of dense tissue to create an image, so the image quality when looking at soft tissues will be poor.

In MRI, while any nucleus with a net nuclear spin can be used, the proton of the hydrogen atom remains the most widely used, especially in the clinical setting, because it is so ubiquitous and returns a large signal. This nucleus, present in water molecules, allows the excellent soft-tissue contrast achievable with MRI.



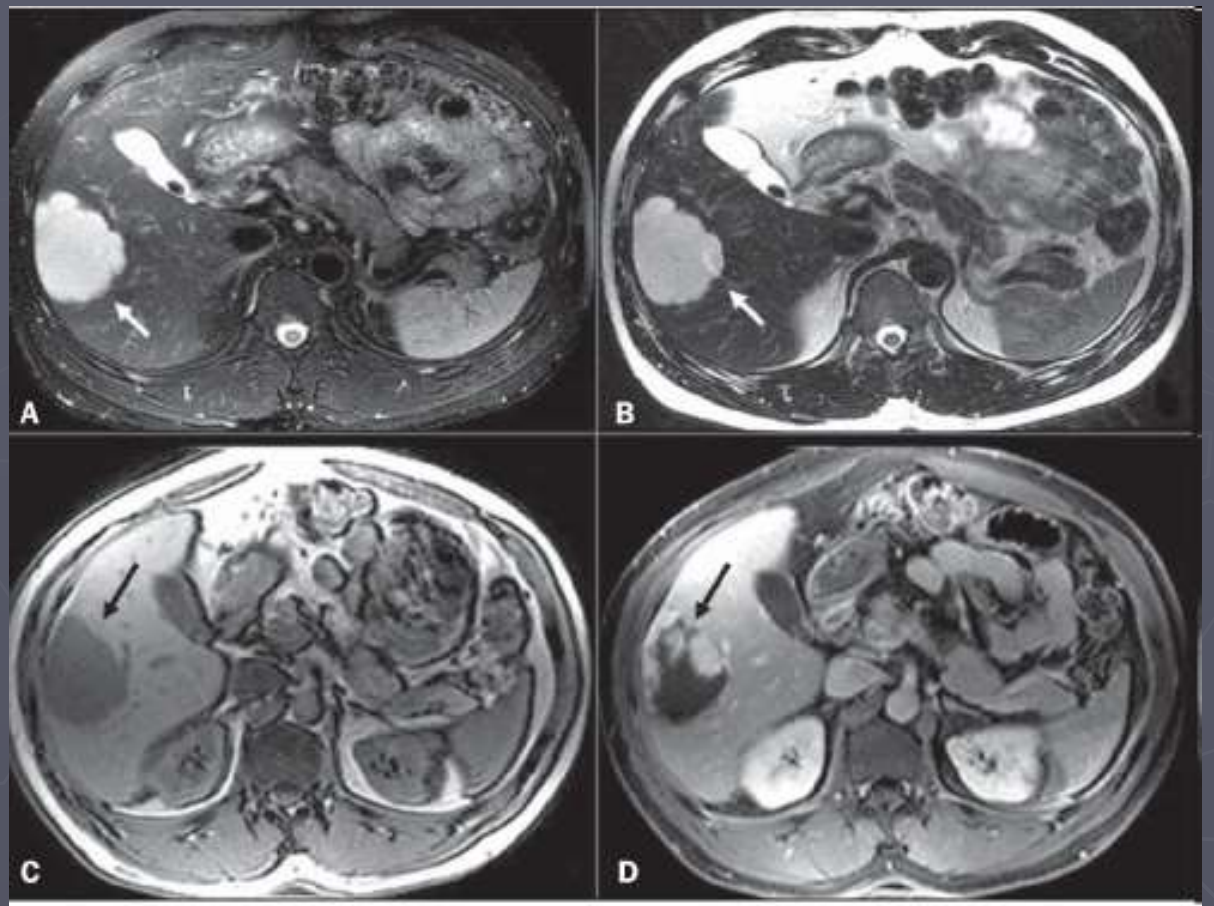


Figure 3. Typical hepatic hemangioma at MRI (arrows). **A:** FSE T2-weighted image with fat-saturation, echo time = 90 ms; **B:** FSE T2-weighted image without fat saturation, TE 180 ms; **C:** precontrast, GRE T1-weighted image; **D:** portal phase, contrast-enhanced GRE T1-weighted image. Note the remarkable, persistent hyperintense signal on the T2-weighted image and peripheral, globular uptake in the post- contrast, portal phase.

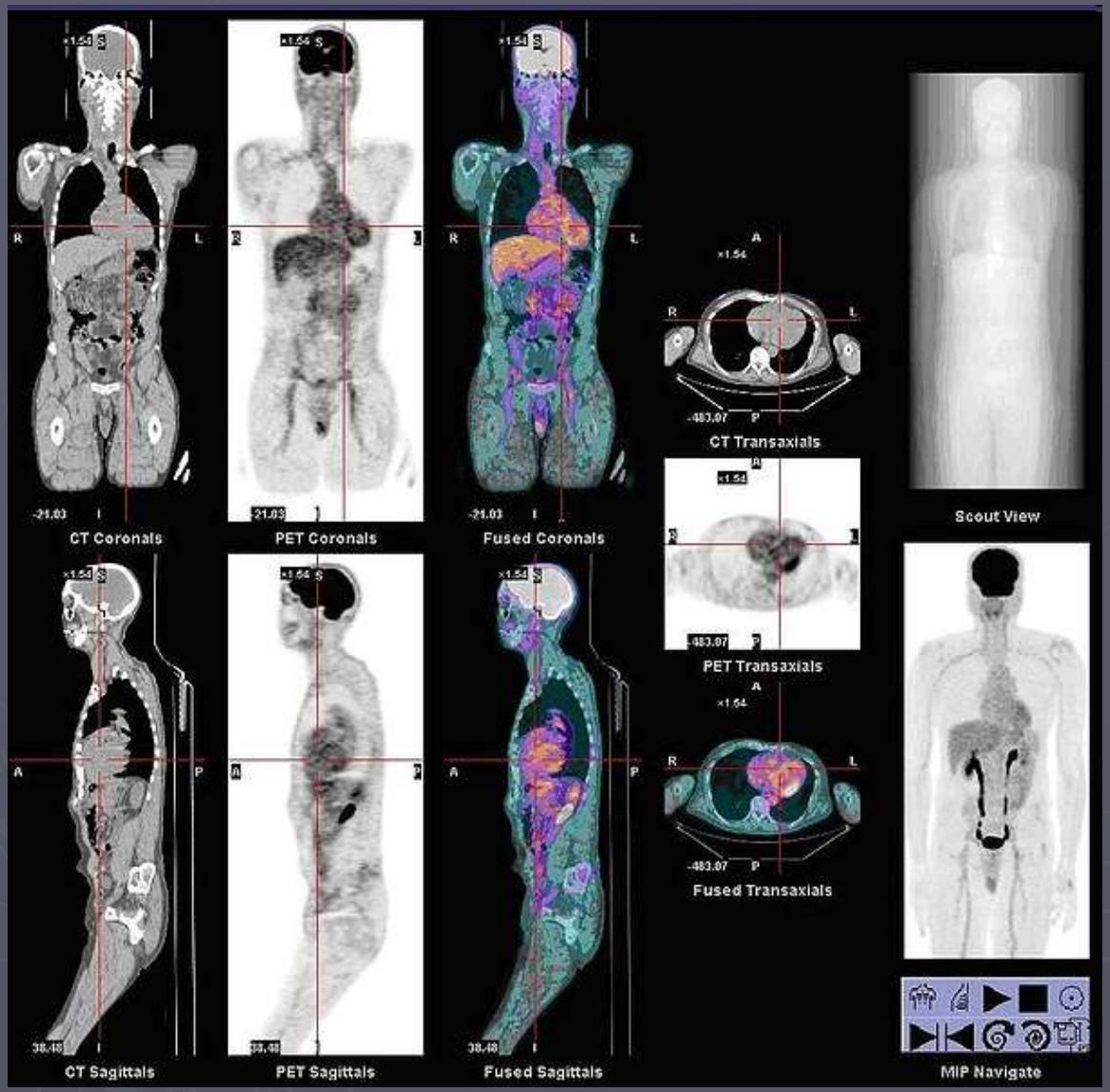
Nuclear medicine

- Scintigraphy ("scint") is the use of internal radionuclides to create two-dimensional[1] images.
- SPECT is a 3D tomographic technique that uses gamma camera data from many projections and can be reconstructed in different planes.
- Positron emission tomography (PET) uses coincidence detection to image functional processes.

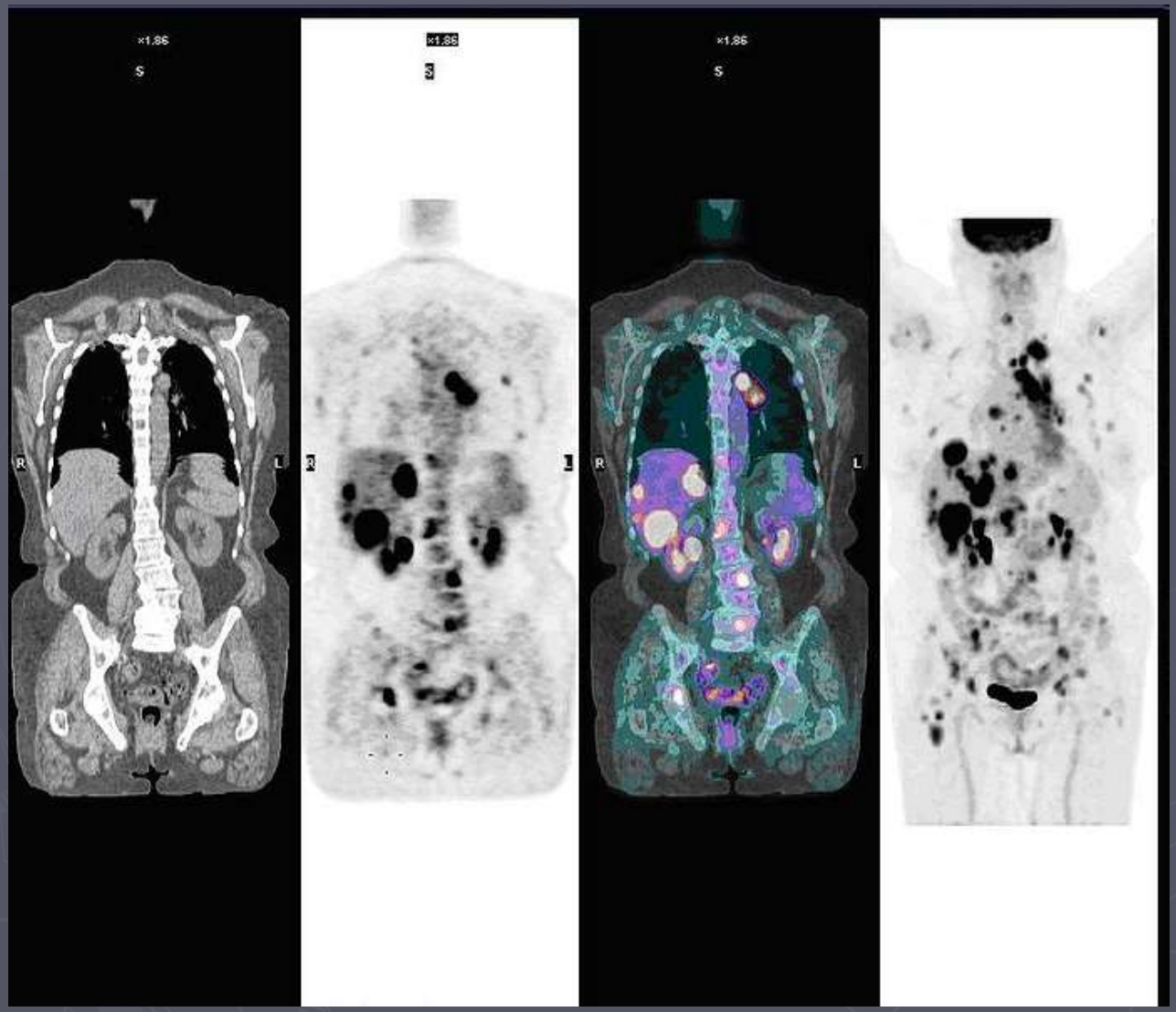
The most commonly used intravenous radionuclides are:

- Technetium-99m (technetium-99m)
- Iodine-123 and 131
- Thallium-201
- Gallium-67
- Fluorine-18 Fluorodeoxyglucose
- Indium-111 Labeled Leukocytes

Nuclear medicine



- Normal whole body PET/CT scan with FDG-18. The whole body PET/CT scan is commonly used in the detection, staging and follow-up of various cancers.



Nuclear medicine

- Abnormal whole body PET/CT scan with multiple metastases from a cancer. The whole body PET/CT scan has became an important tool in the evaluation of cancer.

Which doctor feels more confidently ?

This doctor armed with instrumental methods of diagnostics

Be healthy!