Contrast Radiography

Type of contrast materials

[A] Barium sulphate: for evaluation of the gastrointestinal tract

[B] Water soluble contrast materials

- Oral use: Gastrographin
- IV injection: Urographin, Telebrix
- Intra thecal injection: Iohexol (Omnipaque)

[C] Oily contrast media

Lipiodol ultra-fluida

Water soluble contrast media for oral use

Gastrographin
- For CT scan of the abdomen and pelvis
- For GIT evaluation in cases of:
  - Suspected perforation
  - Suspected anastomotic leakage
  - Suspected intestinal obstruction

Water soluble contrast media for IV injection

- Intravenous urography, IVP
- All CT examination using contrast material CHEST, ABDOMEN, BRAIN,....
- CT angiography of any vessel
  - Carotid
  - Pulmonary
  - Aorta
  - Lower limb vessels
  - Coronary vessels, ........
**Water soluble contrast media for IV injection**
Non ionic contrast media are injectable low osmolar, contrast media agents intended to be therapeutically and biologically inert when injected intra-vascular.

![Ionic and Non Ionic contrast media bottles](image)

**Water soluble contrast media for intra-thecal injection**
Ilohexol [Omnipaque]
- Cervical myelography
- Dorsal myelography
- Lumbar myelography

**Water soluble contrast media used for any canal or duct opacification**
- Evaluation of the salivary gland [Sialography]
- Injection in any external opening in the skin [Fistulography]
- Evaluation of the urethra and urinary bladder [cystourethrography]
- Evaluation of the uterus and tubes [Hystrosalpingiography]

**Water soluble contrast media for injection in any tube inserted surgically**
- **T-tube** cholangiography for assessment of the bile ducts
- Percutaneous nephrostomy for renal evaluation
- Percutaneous cystography for evaluation of the urinary bladder
[C] Oily contrast media for certain investigations

* Lipiodol ultra - fluida
  - HSG
  - Fistulography
  - Some cases of swallow
    - Suspected corrosive stricture
    - Suspected esophageal perforation
    - Suspected surgical anastomotic leakage

Reactions to contrast media injected intravenously
  - Nausea and vomiting
  - Skin rash
  - Dyspnea and tachycardia
  - Hypotension and shock
  - Cardiac arrest

Barium examinations of the GIT
  - Barium swallow [esophagus]
  - Barium meal [stomach]
  - Barium meal follow through [stomach, small intestine]
  - Barium enema [colon]
Radiological terminology in barium studies

[1] Filling defect

[A] Intraluminal lesion
A lesion inside the bowel lumen totally surrounded by Barium

[B] Extraluminal lesion
- Arises from outside
- Compresses the bowel
- Causes narrowing from one side only
- Forms a shallow angle with the bowel wall

[2] Stricture
A segment of luminal narrowing

[A] Tapering end or rat tail

[B] Abrupt with over hanging edges or apple core appearance
[3] Diverticulum
A saccular out pouching connected to the bowel lumen usually fills with barium

Spot film of the duodenal loop showing a sizable diverticulum bulging from the medial edge of the 2nd part of duodenum

[4] Ulceration
Injury of the mucosal surface which becomes visible when the crater is filled with barium

On profile

Outward projection of barium

Enface

Rounded collection of barium

Esophagus
Barium swallow
- The patient swallows barium paste
- The flow is observed on a T.V. monitor and films are taken
  - With the oesophagus full to show filling defects
  - With oesophagus empty to show the mucosal folds
Esophageal abnormalities

[1] Stricture
  • Corrosive
  • Peptic
  • Achalasia
  • Malignant

[A] Corrosive Stricture
Long segment starts at the level of the aortic arch
Accidently in children
Suicide attempts in adults
Radiographic appearance of the stricture:
  – long, with smooth outline
  – Upper end of which is funnel shaped and tapers into normal oesophagus
  – Lost mucosal pattern

Corrosive stricture: Barium swallow showing a long segment of esophageal narrowing with mild proximal esophageal dilatation

Normal barium swallow showing normal esophageal caliber with no evidence of filling defects, ulcerations, strictures or diverticulae
[c] Malignant Stricture

- Occur anywhere in the oesophagus
- Commonly seen in the middle third of esophagus
- Post cricoid carcinoma affects the upper third
- Lower third lesions may simulate achlasia


Esophageal filling defects may be due to benign lesion as liomyoma or malignant lesion like esophageal carcinoma or lymphoma. In all cases endoscopic evaluation is needed for biopsy taking.
Esophageal diverticulae

- Zenker's diverticulum
- Mid esophageal diverticulum
- Epi-phrenic diverticulum

Esophageal carcinoma: Barium swallow showing a large midesophageal filling defect distending the esophageal lumen

Barium swallow showing a small mid-esophageal diverticulum

Zenker's diverticulum: Barium swallow showing a diverticular out pouaching in the neck at the junction of the hypopharynx and upper esophagus
Stomach and Duodenum

**Barium meal**

- Patient fasting for 6 hours before the exam
- Patient drinks fluid barium
- Different views for the stomach are taken by changing the patient’s position as showing in the figure

**Epi - phrenic diverticulum:** Barium swallow a large diverticular out poaching projecting from the lower esophageal segment above the diaphragm

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**Normal barium meal:** In the erect position, the stomach will appear 'J' shaped. The gastric fundus will normally contain gas bubbles. The gastric body and pylorus will be filled with barium
**Testing for Reflux**
- The patient drinks barium fluid
- The patient lies on his right side
- The table is tilted head down
- Patient turns obliquely raising the left side
- Patient swallows water in this position
- Under screen control, barium will be seen refluxing from the stomach into the lower esophagus in cases of GERD

Barium swallow while standing showing normal esophagus. When the patient bends to pick up something at the end of the examination table reflux of barium into the lower esophagus is noted.

**Hiatus hernia**
Herniation of the stomach through the esophageal hiatus above the diaphragm

**Hiatus hernia:** Barium meal examination showing herniation of the gastric fundus above the diaphragm
Gastric abnormalities

[A] Filling defect
- Gastric bezoar
- Benign lesions
- Malignant lesions

Bezoars  Mobile intra-gastric F.B surrounded by Barium
- Tricobizoar made of hair
- Phytobizoar made of plant fibres
- Pharmacobizoar made of drugs

Neoplastic filling defects
Differentiation between benign and malignant filling defects is not usually accurate on radiological bases. Endoscopy is needed for biopsy taking

Gastric Carcinoma: Barium meal showing a large filling defect in the gastric antrum
**Linitis plastica**
Malignant lesions produce irregular filling defect with destruction of the normal mucosa.

**Linitis plastic:** Barium meal showing marked reduction of the gastric lumen with irregular outlines compared to the normal stomach seen in the right image.

**Normal duodenal cap:** Spot view of barium meal showing the normal triangular shape of the duodenal cap which should be radiographed when it is filled with barium (left image) and while filled with air (right image).
**Acute duodenal ulcer:** Double Contrast barium meal study demonstrating an ulcer in the duodenal bulb with radiating mucosal folds. This was confirmed at endoscopy, performed 3 weeks later.

**Chronic duodenal ulcer**
Duodenal ulcer with scarring and marked deformity of the base of the duodenal bulb after healing of a duodenal ulcer.

**Chronic duodenal ulcer:** Barium meal showing the classic trefoil deformity of the duodenal cap due to fibrosis resulting from healed ulcer.
Small Intestine

*Barium meal follow through*

Patient drinks 200-300 ml barium. The barium flow is observed and films are taken at regular intervals until the barium reaches the ascending colon [average time is 2-3 hours after barium intake.]

**Normal small Intestinal series**

![Normal small Intestinal series](image)

*Normal small Intestinal series*: Patient drinks 200-300 ml barium. The flow of barium through the stomach and intestine is observed and films are taken at regular intervals until the barium reaches the ascending colon [average time is 2-3 hours after barium intake.]
Corhn’s disease
Sub mucosal lymphoid tissue hyperplasia → thickening and rigidity of the affected segment → luminal narrowing = Stricture

Barium enema
Barium enema is a valuable diagnostic tool that helps detect abnormalities in the large intestine. Barium enema, along with colonoscopy, remains standard in the diagnosis of colon cancer, ulcerative colitis, and other diseases of the colon. Colonoscopy allows both therapeutic resection of mucosal lesions as well as diagnostic biopsy.
Ulcerative Colitis

- Edematous inflammatory infiltration of the **mucosa** which ulcerates
- The colon is diffusely affected with involvement of the rectum
- Loss of haustral pattern

**Normal barium enema:** Double contrast enema showing the normal appearance of different colonic segments

**Colonic diverticular disease:** Barium enema examination showing few colonic diverticulae mainly affecting the sigmoid and descending colon with no evidence of complications
**Ulcereative colitis:** Double contrast barium enema shows a featureless descending and sigmoid colon, lacking normal haustral marking. No evidence of stenoses, masses or fistula formation. Normal ascending and transverse colon appear normal.

**Sigmoid carcinoma**
Barium enema study demonstrating an "apple core" lesion most consistent with carcinoma of the bowel.

**Cancer colon:** Barium enema examination showed malignant stricture with typical apple core configuration seen involving the distal part of the transverse colon [arrow].
**Water soluble contrast media for IV administration**
- Intravenous urography, IVP
- All CT examination using contrast material

**Non Ionic**

**Intravenous urography [ IVU ]**
**Diagnostic value**
- Show the renal function
- UT obstruction
- Renal an bladder masses
- Congenital anomalies

**Contraindicated in patients with :**
- Renal impairment
- Hypersensitivity to contrast media

[Image of normal IV urography]
Chronic pyelonephritis
- Small kidney with irregular outline
- Cortical thinning

Chronic pyelonephritis: Spot film from an IV urogram showing small sized right kidney with cortical irregularities and distended pelvicalyceal system

Water soluble contrast media for oral use
Gastrographin
- For CT scan of the abdomen and pelvis
- For GIT evaluation in cases of:
  - Suspected perforation
  - Suspected anastomotic leakage
  - Suspected intestinal obstruction

Patient preparation
Oral contrast material to opacity the GIT
[ gastrographin 38% diluted by water to 4% ]

Not indicated in
- Acute abdominal trauma
- Acute renal colic
- Dehydrated patients
Water soluble contrast media for intrathecal injection

- Cervical myelography
- Dorsal myelography
- Lumbar myelography

Iohexol (omnipaque)
**Normal lumbar myelography:**
Oblique and lateral views showing normal opacification of the thecal sac by the injected contrast medium with no evidence of disc lesions.

**Multiple discs:** Lateral view of a lumbar myelogram showing multiple anterior indentations of the contrast opacified thecal sac due to multiple disc bulges.

**Lumbar disc herniation, myelography and MRI:** Frontal and lateral lumbar myelography showing a large indentation of the myelography column opposite L4/5 disc space denoting the presence of disc herniation. The herniated disc is well demonstrated in the sagittal MR image on the right.
Water soluble contrast media used for any canal or duct opacification

[1] Evaluation of the salivary gland [Sialography]

**Parotid Sialography:** The opening of the parotid duct is present opposite the 2nd upper molar tooth. A plastic cannula is introduced into the opening and contrast medium is injected. The image on the right shows the normal appearance of the main parotid duct as well as its intraparotid branches. No evidence of filling defects, strictures or masses.

**Submandibular duct stone:** The opening of the submandibular duct is present in the mouth floor underneath the tongue on both sides of the midline plane. A plastic cannula is inserted into the duct and a contrast medium is injected. The image on the right shows a small filling defect (arrow) in the main submandibular duct representing a stone.
The tip of a urinary catheter is introduced into the urethral opening. Contrast medium is injected to opacify the urethra and urinary bladder. P= penile urethra b= bulbar urethra m= membranous urethra pr = prostatic urethra B= urinary bladder

Ascending urethrography

Ascending cystography

Stricture urethra: Ascending cytourethrography showing a 2cm segment of tight urethral narrowing in the penile part of the urethra
Evaluation of the uterus and fallopian tubes [Hystro salpengiography, HSG]

- Primary and secondary infertility
- Suspected uterine anomalies or masses
- Suspected tubal block or peritubal adhesions

**Normal HSG:** After application of a cosco speculum, the cervical opening is cannulated and a contrast medium is injected. The image shows the normal triangular appearance of the uterus with normal caliber of the fallopian tubes eliciting free peritoneal spill from their fimbrial ends.

**Right hydrosalpenx:** HSG showing normal appearance of the uterine shadow with patent left fallopian tube. The right tube is seen dilated at its fimbrial part with limited peritubal contrast spill.

**Injection in any tube inserted surgically**

- T-tube cholangiography for assessment of the bile ducts
- Percutaneous nephrostomy for renal evaluation
- Percutaneous cystography for evaluation of the urinary bladder
- Injection in any external opening in the skin [Fistulography]
**Fistulography:** In patients with branchial cleft sinus or fistula, a discharging opening in the lower neck is usually present. A small cannula is introduced into this opening and contrast medium is injected. This image shows the fistulous tract ending near the mouth floor with no evidence of communication with the pharynx.

**T-tube cholangiography:** After open surgical removal of the GB a T-shaped tube was usually inserted into the CBD to be removed few days later after confirmation of the CBD patency. Before removal of the tube, contrast medium is injected into the external limb of the T-tube. This image shows patent CBD with free passage of the injected contrast into the duodenum.

**Percutaneous nephrostomy:** cases of advanced hydronephrosis a tube is inserted percutaneously into the dilated collecting system to decompress the distended calyces, then a contrast medium is injected to show the cause of obstruction. This image shows dilated tortuous ureter down to a stricture in its pelvic part with multiple filling defect (calculi) proximal to the stricture site.