Clinical Radiology

6th Year

Imaging Gastrointestinal System

Name of the investigation

- Simple abdominal radiograph
- Barium study of the esophagus
- Barium study of the stomach
- Barium study of the duodenum (Duodenography)
- Barium study of the small bowel
- Irrigoscopy (Barium enema)

Sample description of a simple abdominal radiograph

Patological calcifications, free gas and air-fluid levels are not detected.

There is increased gas formation of the colon (if detected).

In case of detecting the patological signs indicated above, specify: localization of calcification according to the vertebral column; free gas localization; type of air-fluid levels *(Ex. air-flid levels with longer horizontal diameter, situated in the central region of the abdomen).*

If your discover other modifications, (Ex. scoliosis; additional ossifications, bony fractures etc.), fix them.

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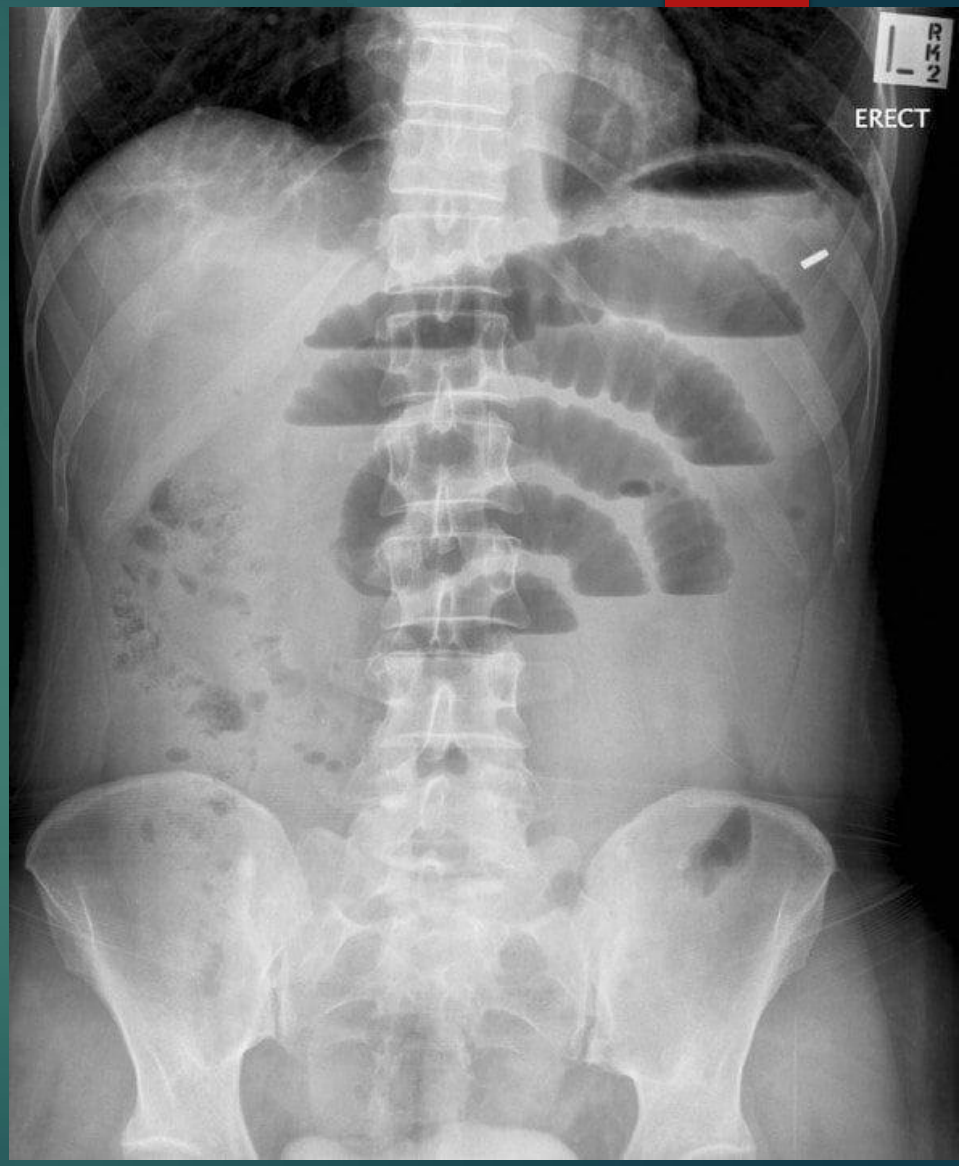
Bowel obstruction

Normal

Bowel obstruction

Normal



Bowel obstruction

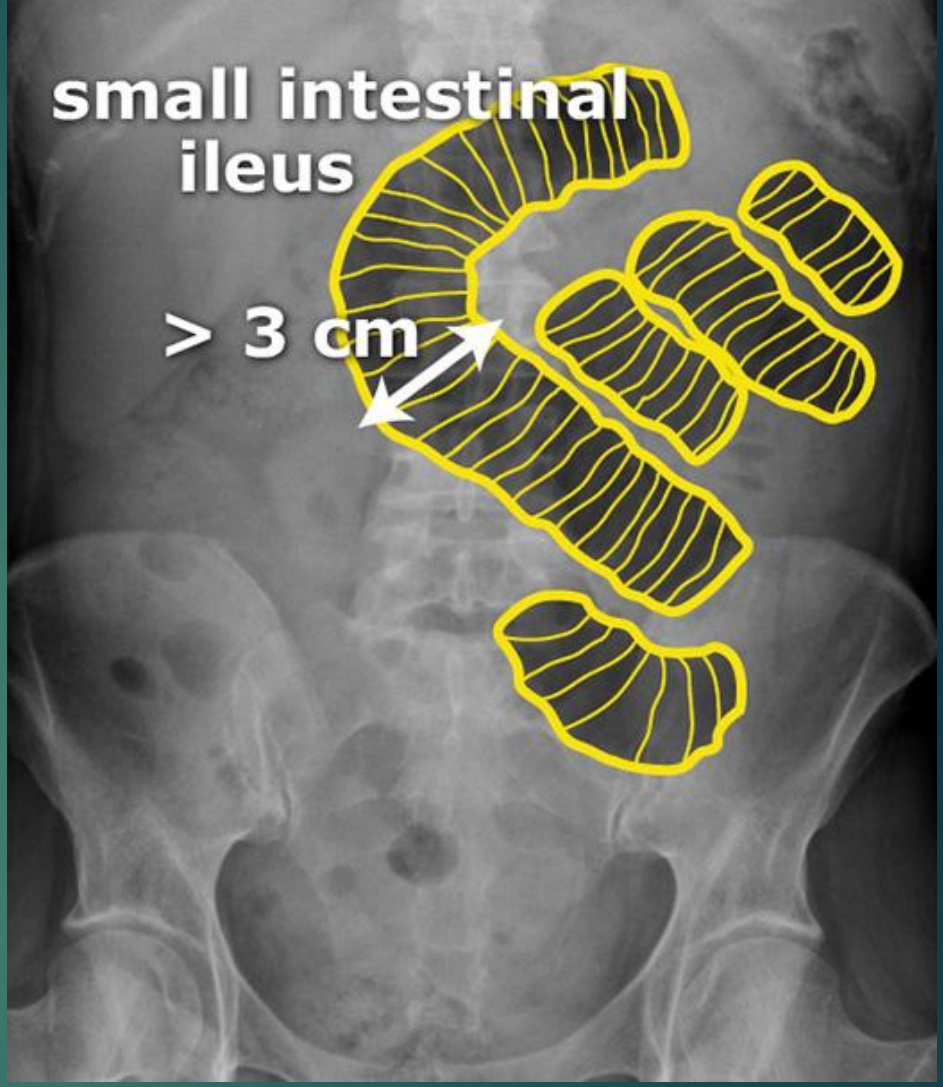
Bowel obstruction

Supine plain abdominal radiography showing multiple loops of dilated small bowel consistent with small bowel obstruction.

When evaluating the air-fluid level, always realize which technique was used to create the image.
Due to gravity, you will NOT see the air-fluid level on a supine position.

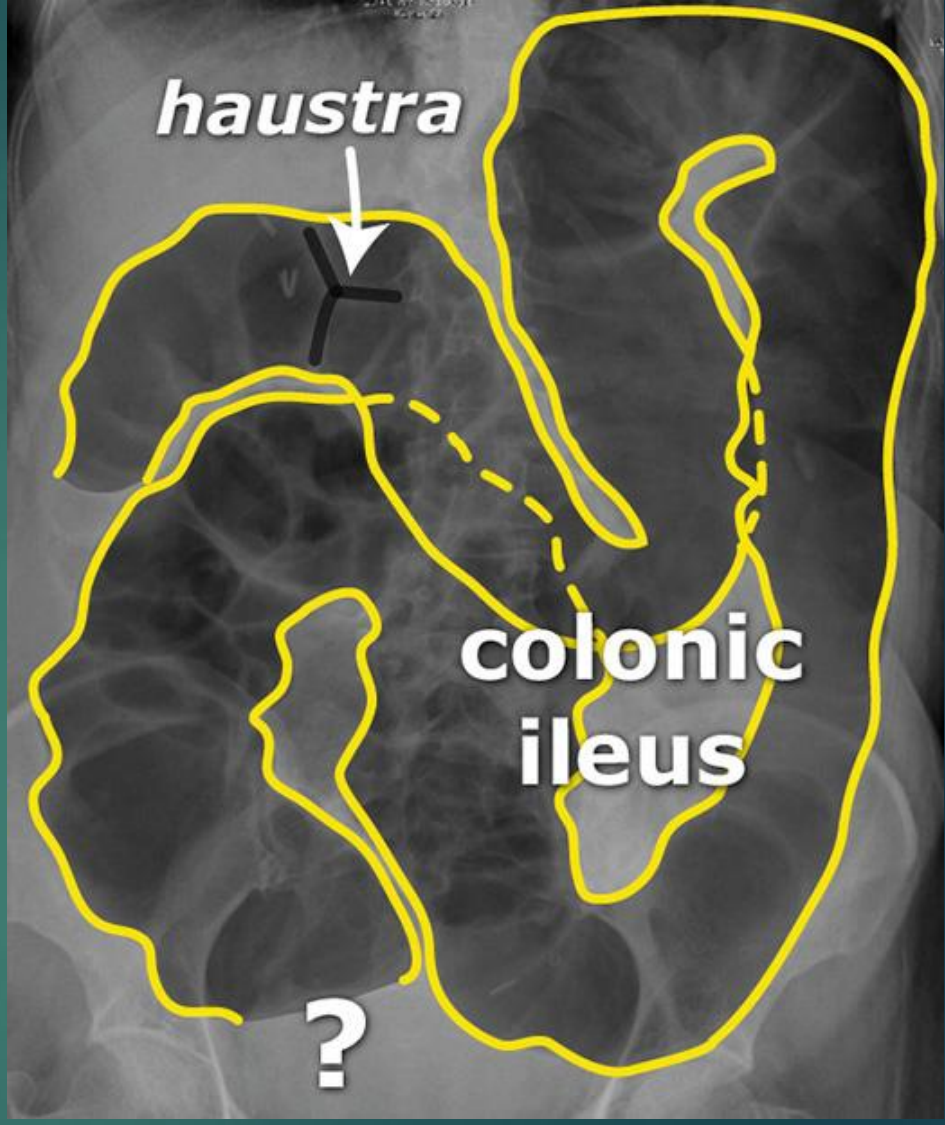
Bowel obstruction

Abdominal x-ray, supine and upright in the same patient



The 3/6/9 rule is a good rule of thumb for pathologically widened intestinal loops. The upper limit of **3 cm applies to the small intestinal** loops, **6 cm for the colon** and **9 cm for the cecum** (blind intestine).

Source: https://www.startradiology.com/internships/internal-medicine/abdomen/abdominal-x-ray/index.html



Signs of colonic ileus:

- Gas-dilated loops proximal of obstruction
- Collapsed colon distal from obstruction
- Dilated small intestinal loops and incompetent Bauhin's valve

Source: https://www.startradiology.com/internships/internal-medicine/abdomen/abdominal-x-ray/index.html

Large Bowel Obstruction

Key points

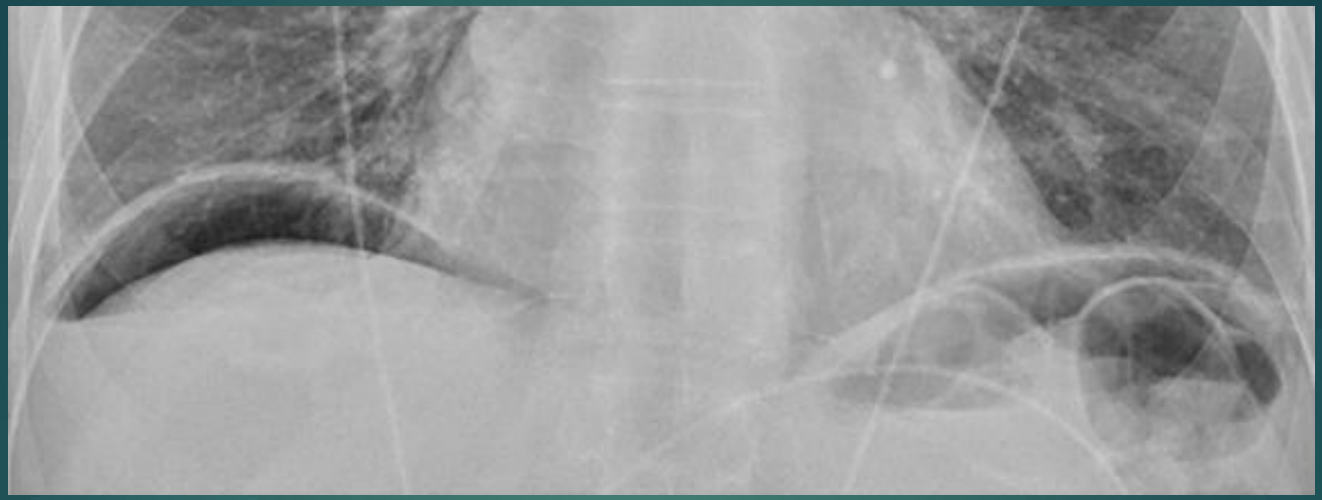
✓Dilatation of the caecum >9cm is abnormal

✓Dilatation of any other part of the colon >6cm is abnormal

✓Abdominal X-ray may demonstrate the level of obstruction

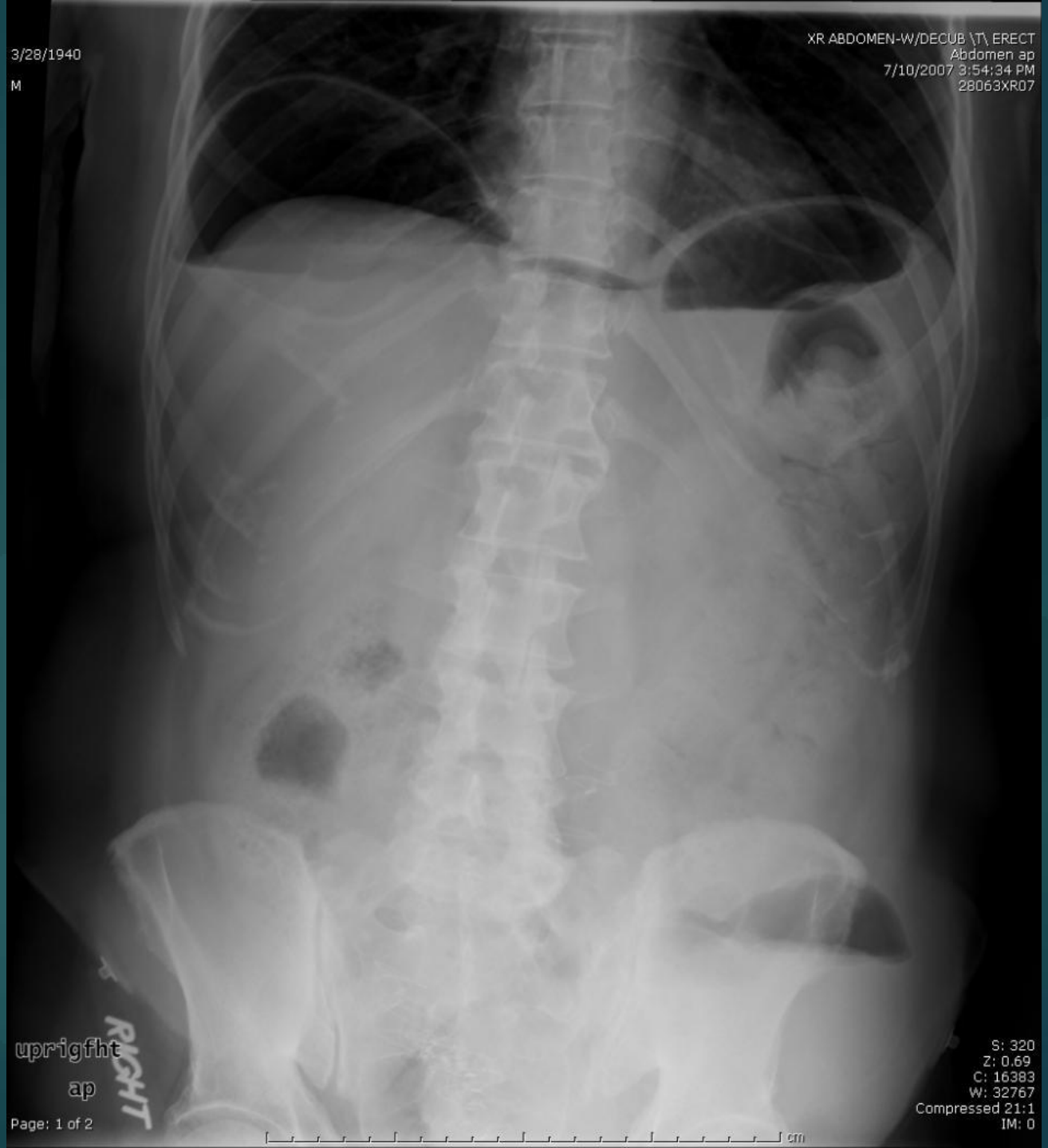
✓Abdominal X-ray cannot reliably differentiate mechanical obstruction from pseudo-obstruction

Pneumoperitoneum



Source: https://www.startradiology.com/internships/internal-medicine/abdomen/abdominal-x-ray/index.html

Crescentic gaz under the right hemidiaphragm ➔ visceral perforation


3/28/1940
M
XR ABDOMEN-W/DECUB \T\ ERECT
Abdomen ap
7/10/2007 3:54:34 PM
28063XR07
uprigfht
ap
RIGHT
Page: 1 of 2
S: 320
Z: 0.69
C: 16383
W: 32767
Compressed 21:1
IM: 0
cm

Rigler's sign

Rigler's sign/double wall sign - when there is a large amount of free air, both the inside and outside of the intestinal wall are visible.

Source: https://www.startradiology.com/internships/internal-medicine/abdomen/abdominal-x-ray/index.html

Rigler's sign

Massive pneumoperitoneum is evident by the excessive free gas in the abdominal cavity, including the bilateral subphrenic spaces and surrounding the edges of the liver (hepatic edge sign). Bowel double wall sign (or Rigler sign) is well-demonstrated.

Some of the bowel loops are significantly dilated. Gas-fluid levels are seen in the dilated lower abdominal loops. No rectal gas is seen.

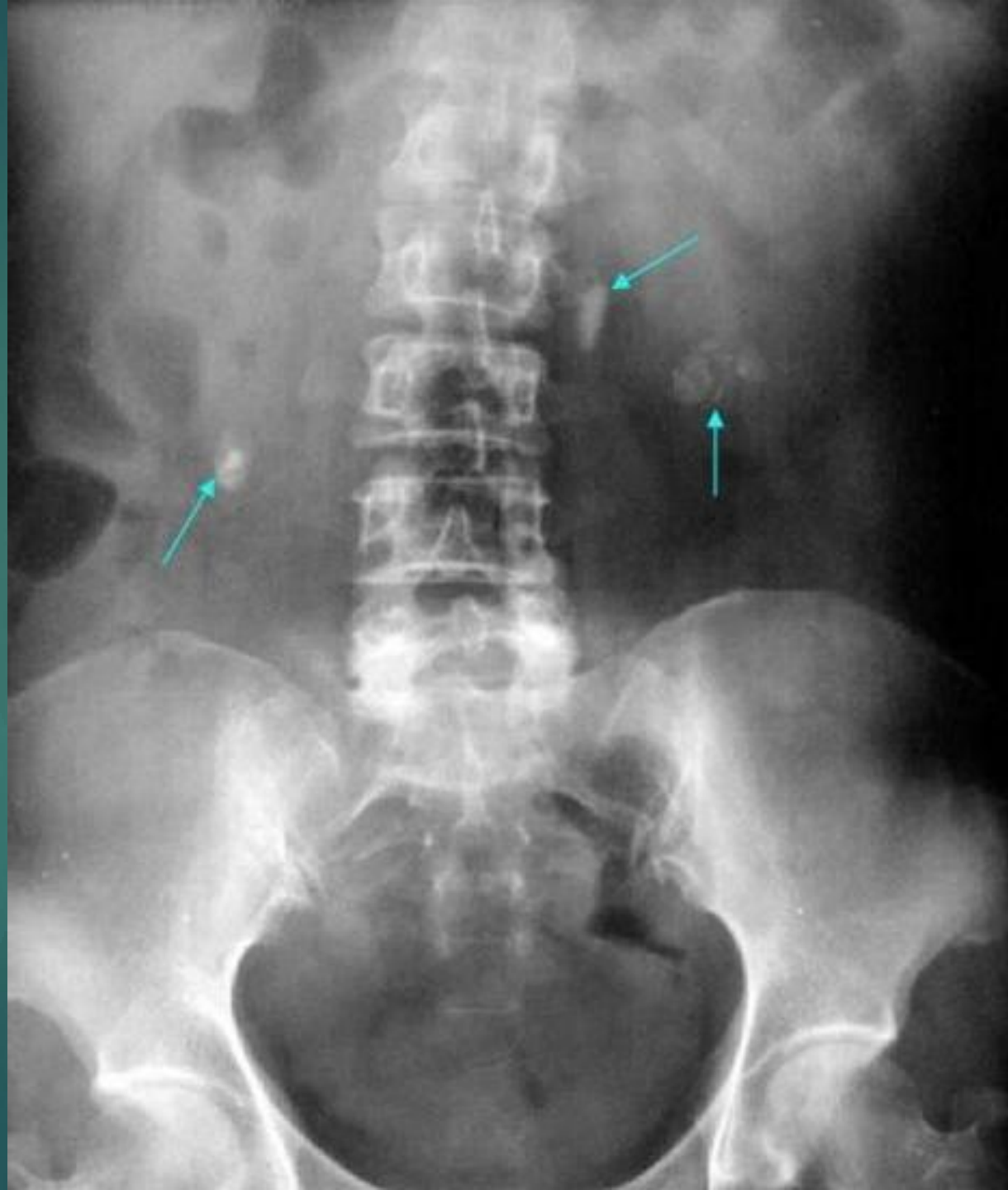
Source: https://radiopaedia.org/cases/pneumoperitoneum-42?lang=us

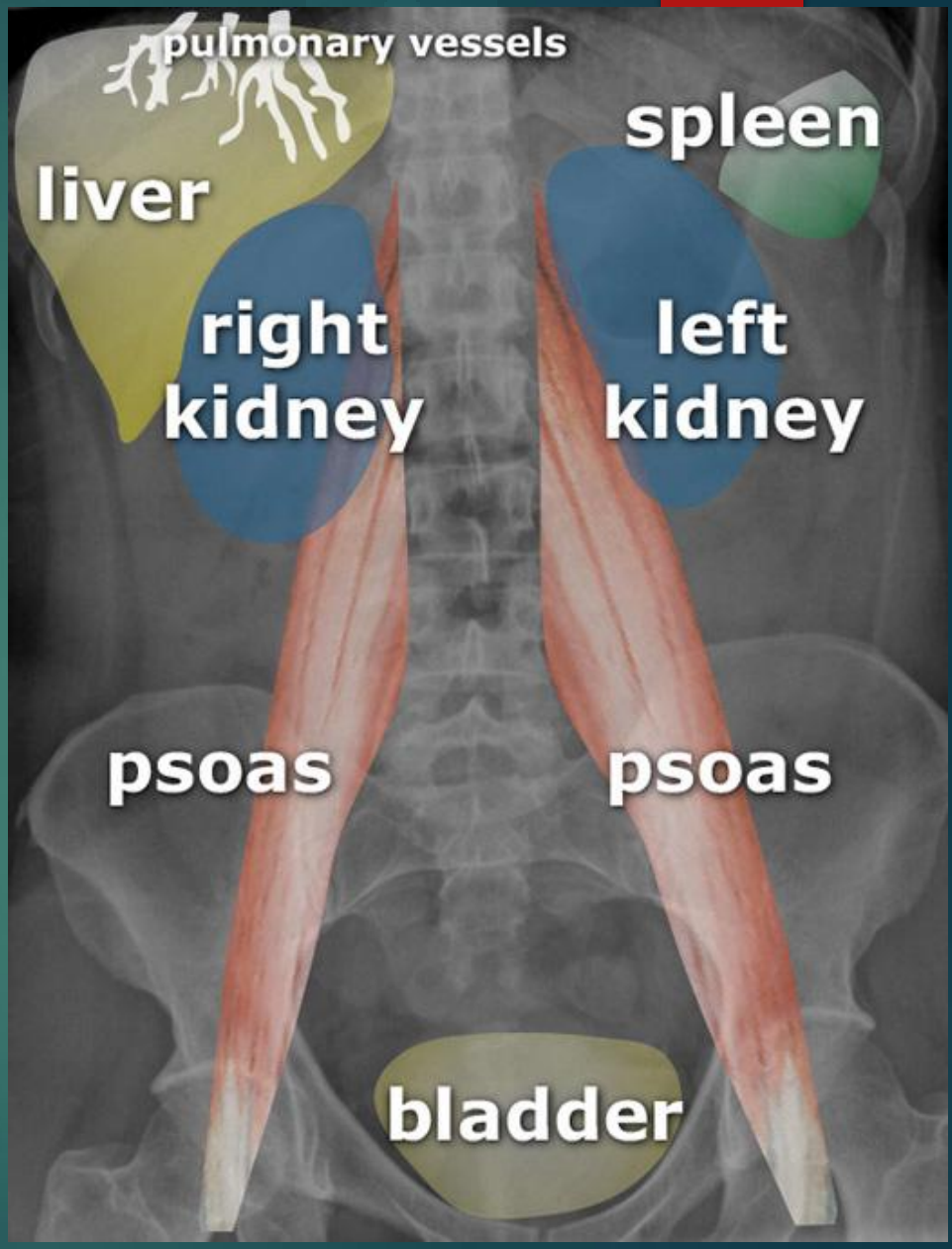
Foreign bodies

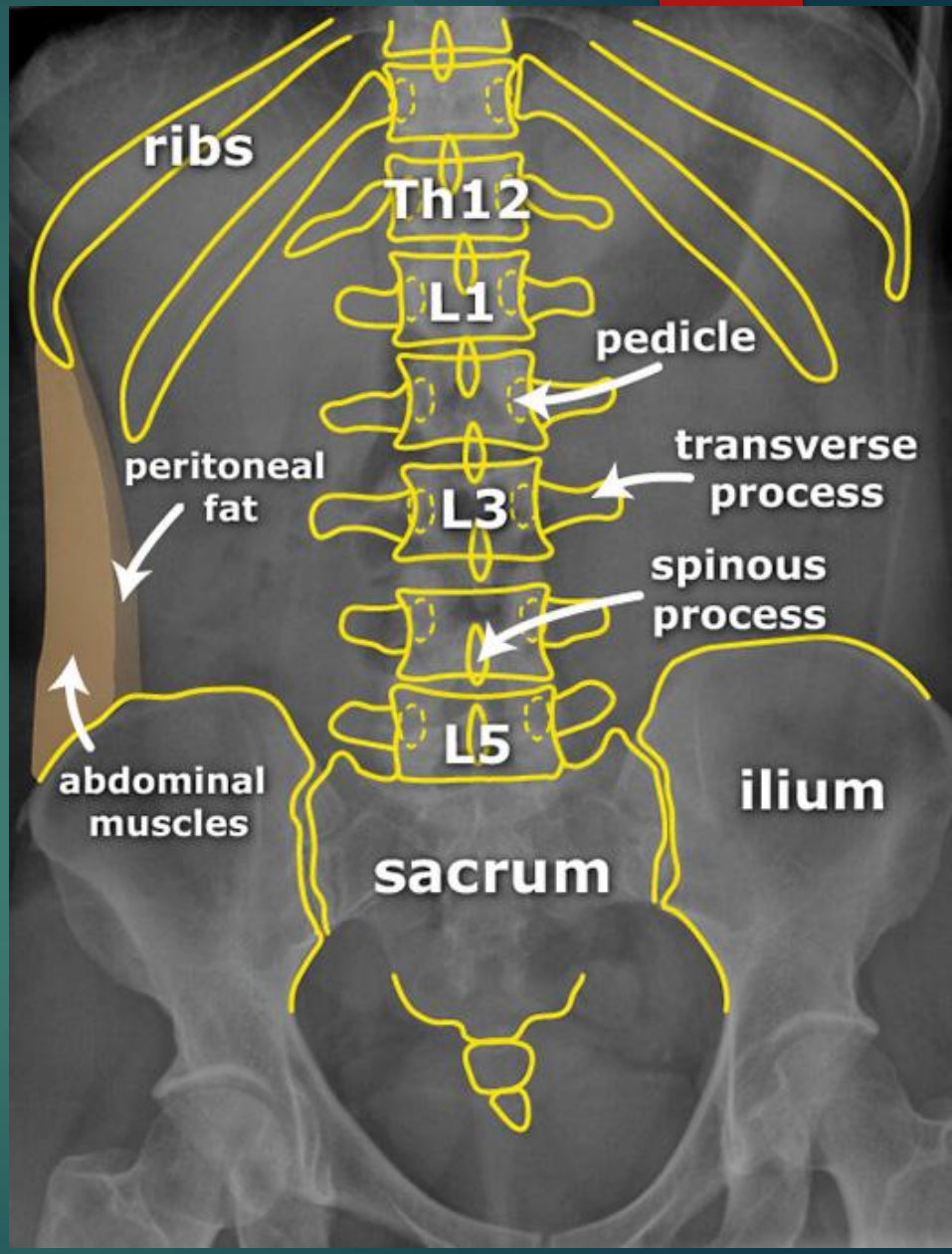
Calcifications:

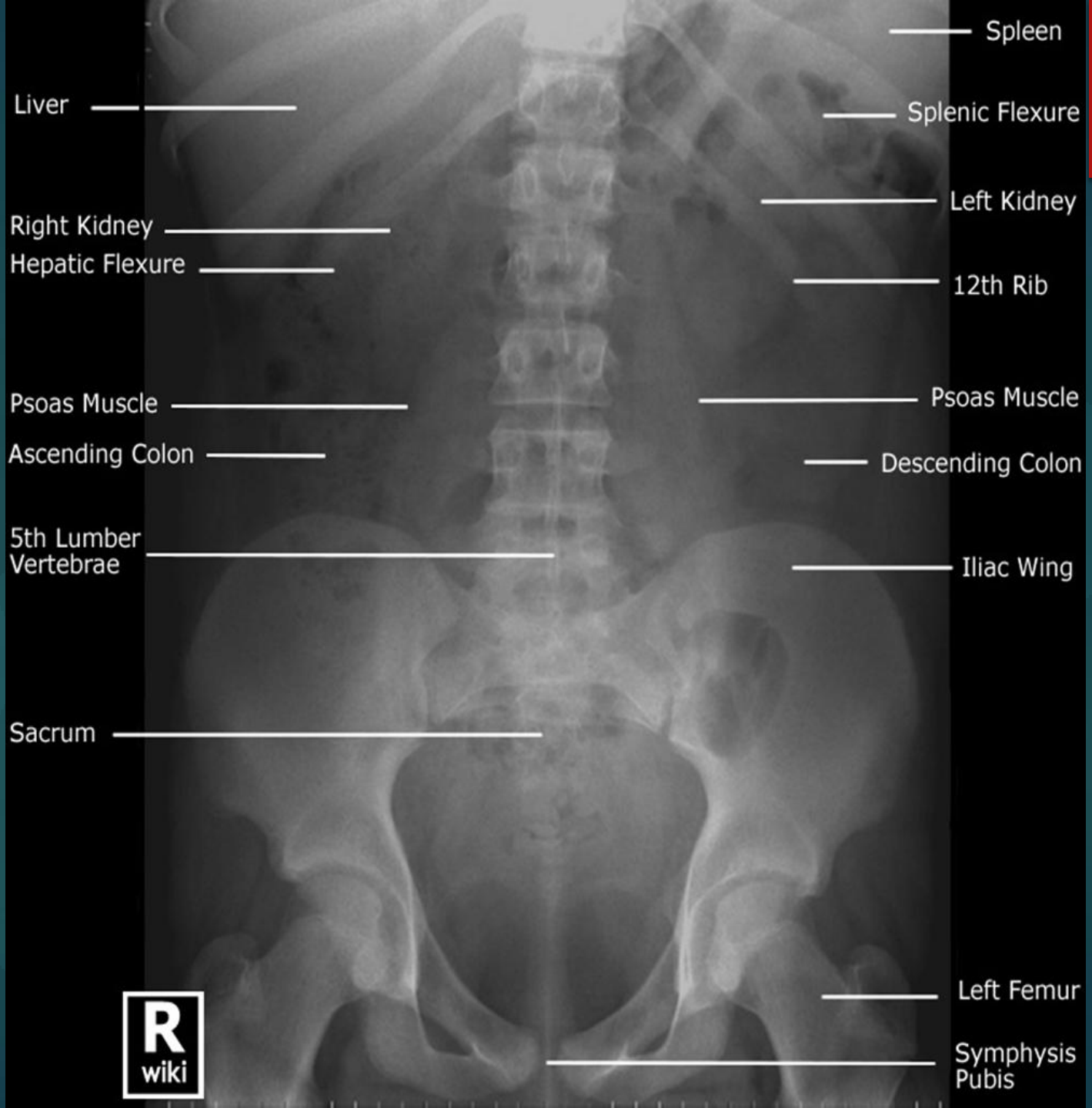
Chronic pancreatitis

Calcifications, stones




pulmonary vessels
liver
spleen
right kidney
left kidney
psoas
psoas
bladder


ribs
Th12
L1
pedicle
transverse process
peritoneal fat
L3
spinous process
L5
abdominal muscles
ilium
sacrum


Spleen
Liver
Splenic Flexure
Left Kidney
Right Kidney
Hepatic Flexure
12th Rib
Psoas Muscle
Psoas Muscle
Ascending Colon
Descending Colon
5th Lumber Vertebrae
Iliac Wing
Sacrum
Left Femur
Symphysis Pubis
R
wiki

ESOPHAGUS. Location, shape and size of the esophagus are usual. The contours of the esophagus are well-defined. There can be detected 3-4 folds of the mucosa which are traced throughout. The areas of physiological narrowing of the esophagus without features. The angle of His is within the normal range. *If your discover any modification, fix it.*

STOMACH. Location, shape and size of the stomach are usual. The stomach doesn't contain food rests or excessive amount of gastric juice. In its anatomical and functional characteristics the stomach corresponds to the normostenic constitutional type. The contours of the stomach along the lesser curvature are regular, distinct; along the greater curvature – uniformly serrated. The folds of the mucous membrane are not modified. *If your discover any modification, fix it (ex. Defect of the contour plus filling (niche) at the lsser curvature etc).*

DUODENUM. The duodenal bulb is of usual location, shape and size, its contours are regular and are well-defined. The folds of the mucous membrane without features. The postbulbar segments without features. The duodeno-jejunal flexure is not modified. *If your discover any modification, fix it.*

SMALL INTESTINE (jejunum and ileum). The contrastation is usual over a considerable distance, the folds of mucosa have a usual pattern. *If your discover any modification, fix it.*

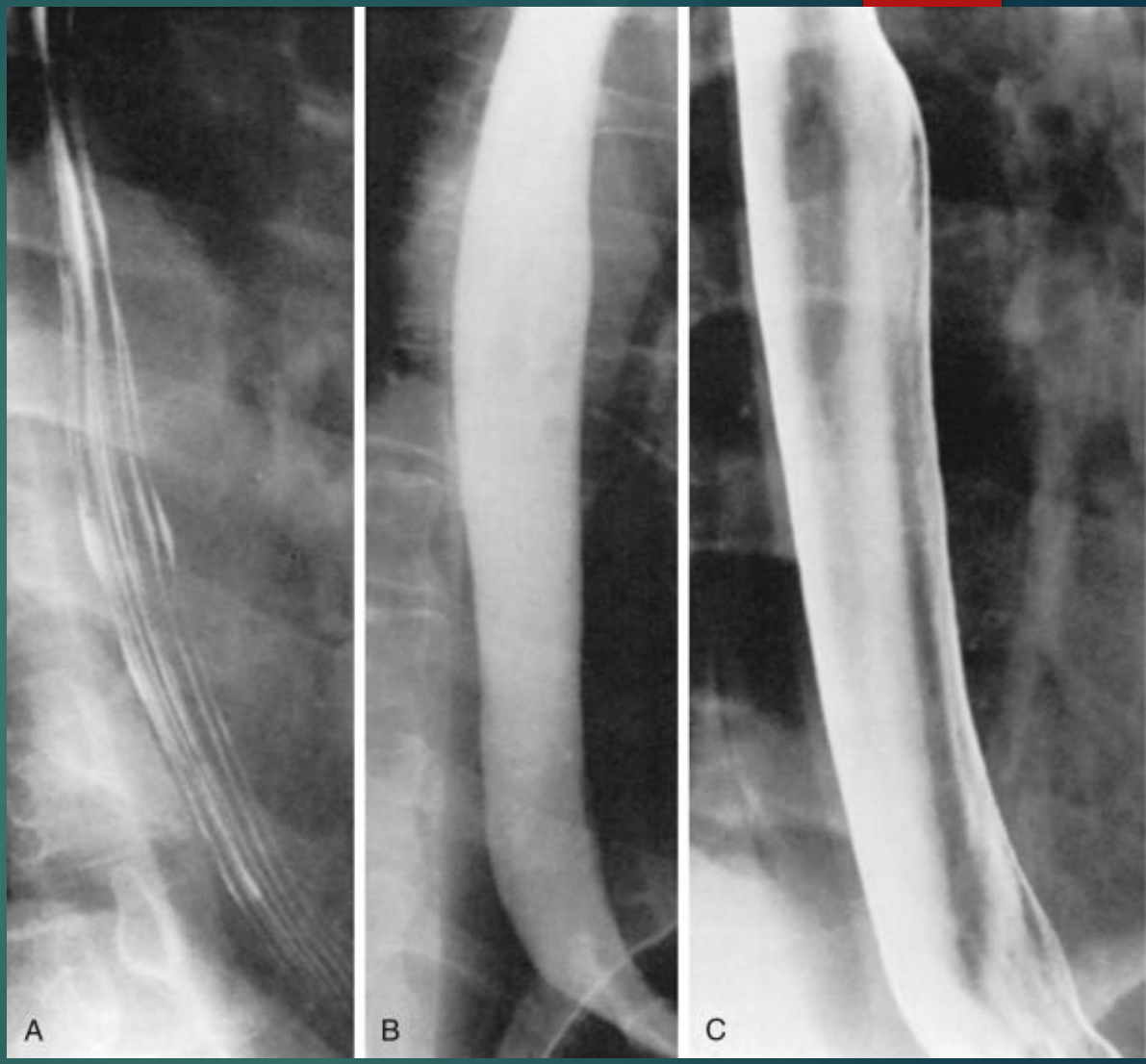
LARGE INTESTINE (barium enema). All parts of the large intestine and the appendix are filled with a contrast agent consistently and evenly. Their location and diameter are usual. Haustration and contours are uniform, well defined. *If your discover any modification, fix it (ex. In the level of sigmoid colon is detected a minus-filling defect of contour with irregular borders, for a short distance, with asymmetric narrowing of the lumen, corresponding to "apple core" sign)*

https://drive.google.com/drive/folders/139Bet-oyS8NRAYYACBLx_UnBtf-_RLvB?usp=sharing

A. Mucosal relief view. Obtained with a **small** volume of barium. With the esophagus collapsed and coated, the normal longitudinal folds are seen. These views are particularly useful for showing abnormalities involving the submucosa, such as esophageal varices.

B. Single-contrast view. Obtained with a **large** volume of barium, with the patient continuously drinking barium in **prone position**, the barium-filled esophagus is shown. Enables visualization of contour abnormalities, strictures, and large polypoid defects.

C. Double-contrast view. With the patient in the upright position, the mucosal surface is coated with a thin layer of barium, then the lumen is distended with gas. Enables visualization of subtle mucosal lesions, such as the early changes of inflammatory or neoplastic lesions.

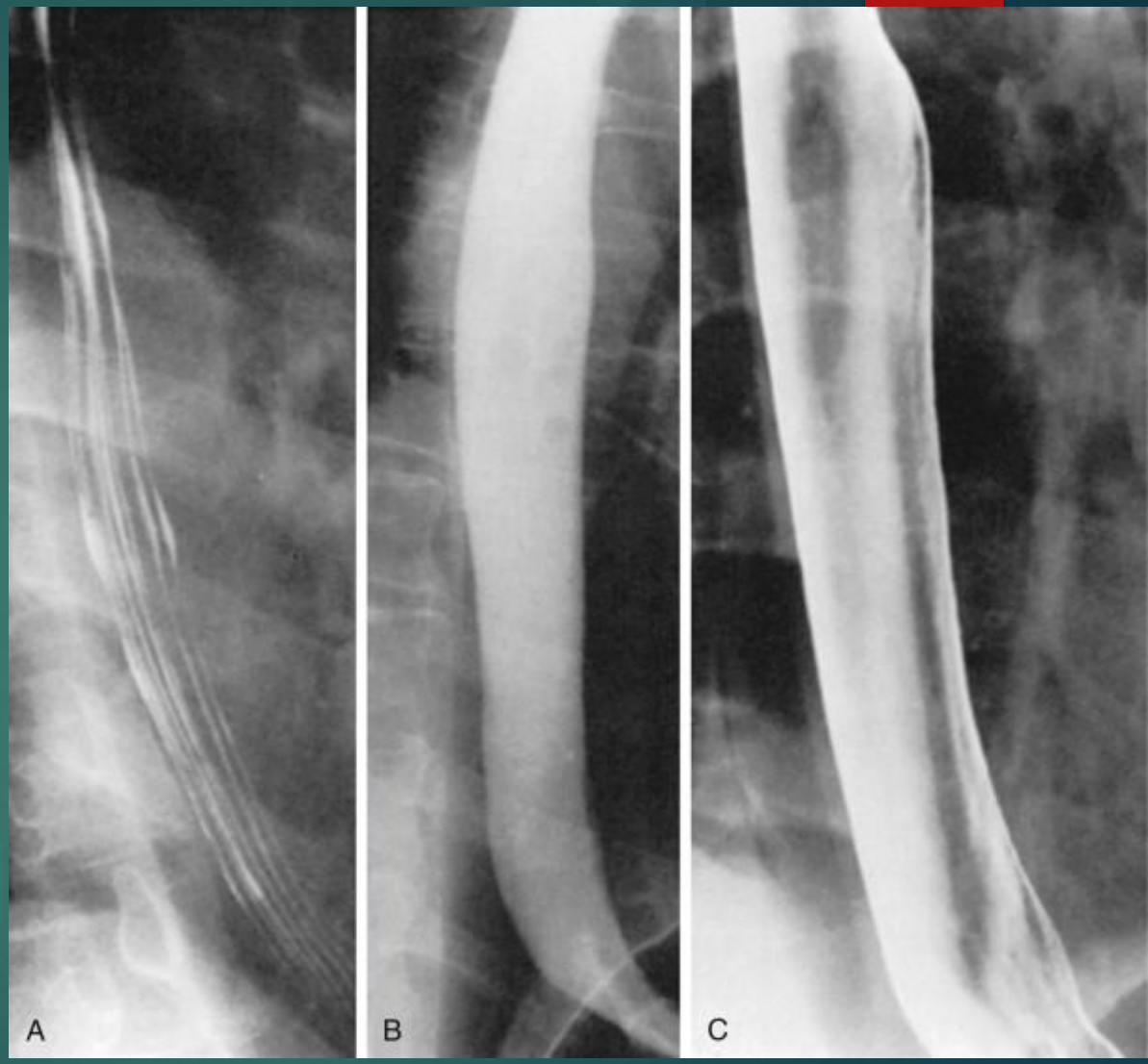


Source: https://radiologykey.com/barium-studies-single-and-double-contrast/

Barium study of the esophagus

Location, shape and size of the esophagus are usual. The contours of the esophagus are well-defined. There can be detected 3-4 folds of the mucosa which are traced throughout. The areas of physiological narrowing of the esophagus without features. The angle of His is within the normal range.

If your discover any modification, fix it.



Source: https://radiologykey.com/barium-studies-single-and-double-contrast/

Achalasia

- An esophageal motility disorder characterized by incomplete lower esophageal sphincter (LES) relaxation, increased LES tone, and lack of peristalsis of the esophagus.
- Acute tapering at the lower esophageal sphincter and narrowing at the gastro-esophageal junction, producing a "bird's beak" or "rat's tail" appearance.
- Dilatation of the esophagus above the narrowing is also present.

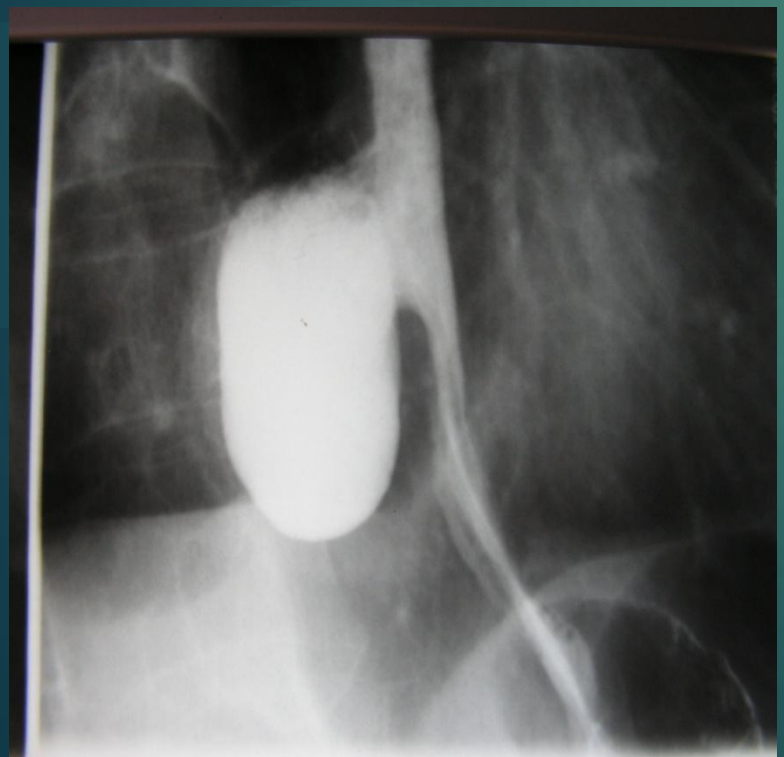
Esophageal achalasia

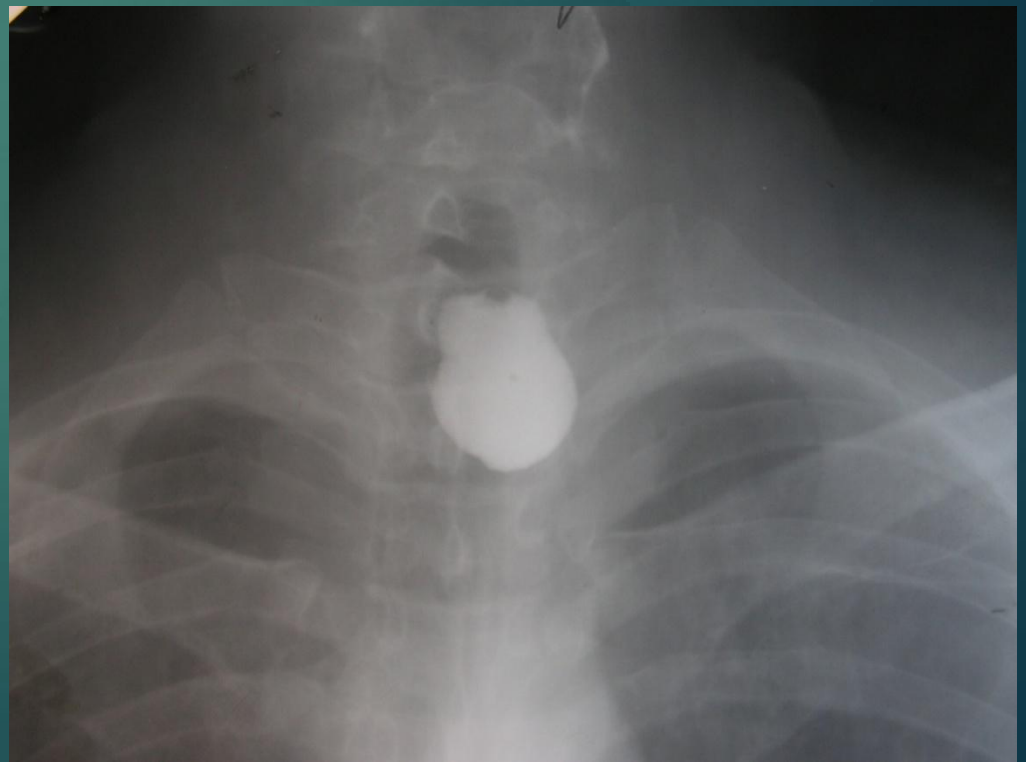
Acute tapering at the lower esophageal sphincter and narrowing at the gastro-esophageal junction, producing a "bird's beak" or "rat's tail" appearance.

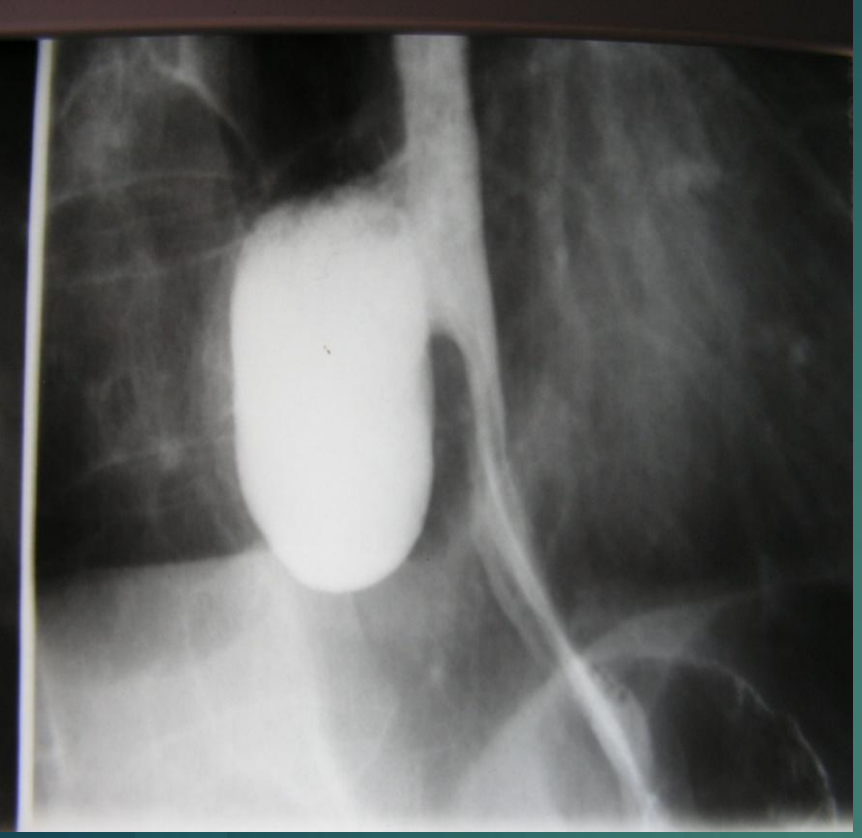
Esophageal diverticula

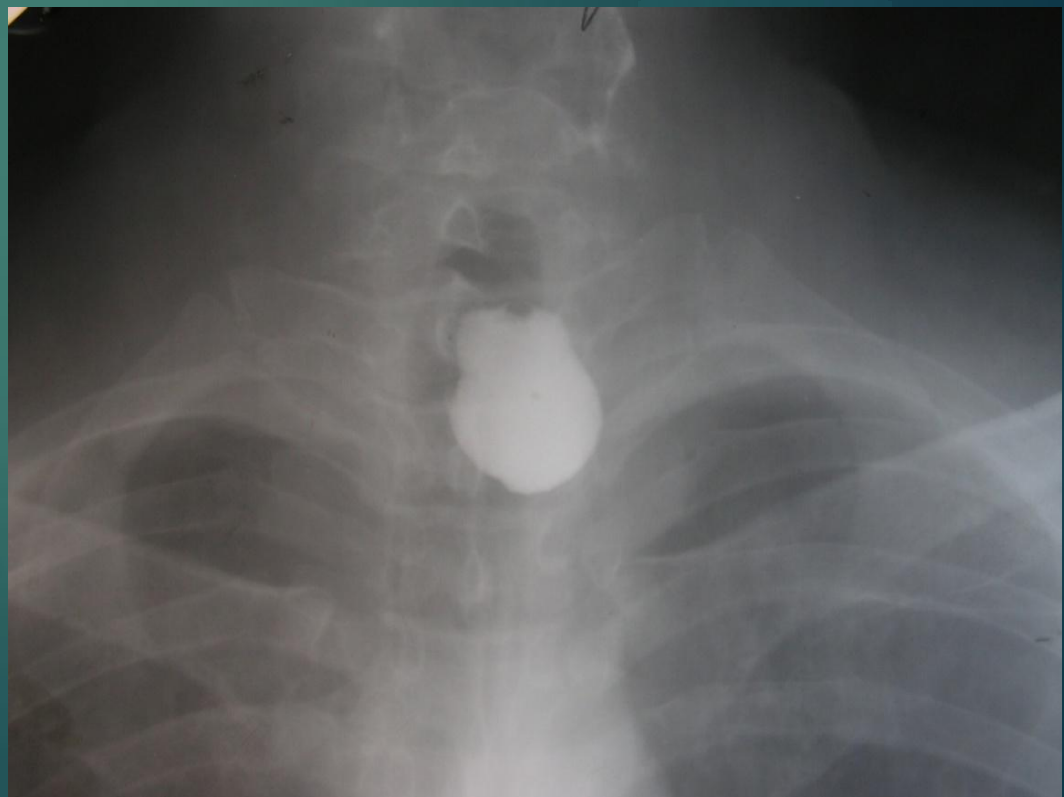
- **True diverticula** involve all layers, including muscularis propria and adventitia.
- **False diverticula** involve only the submucosa and mucosa without affecting the muscular layers or adventitia.

- **Traction esophageal diverticula** usually occur due to scarring from mediastinal or pulmonary tuberculosis



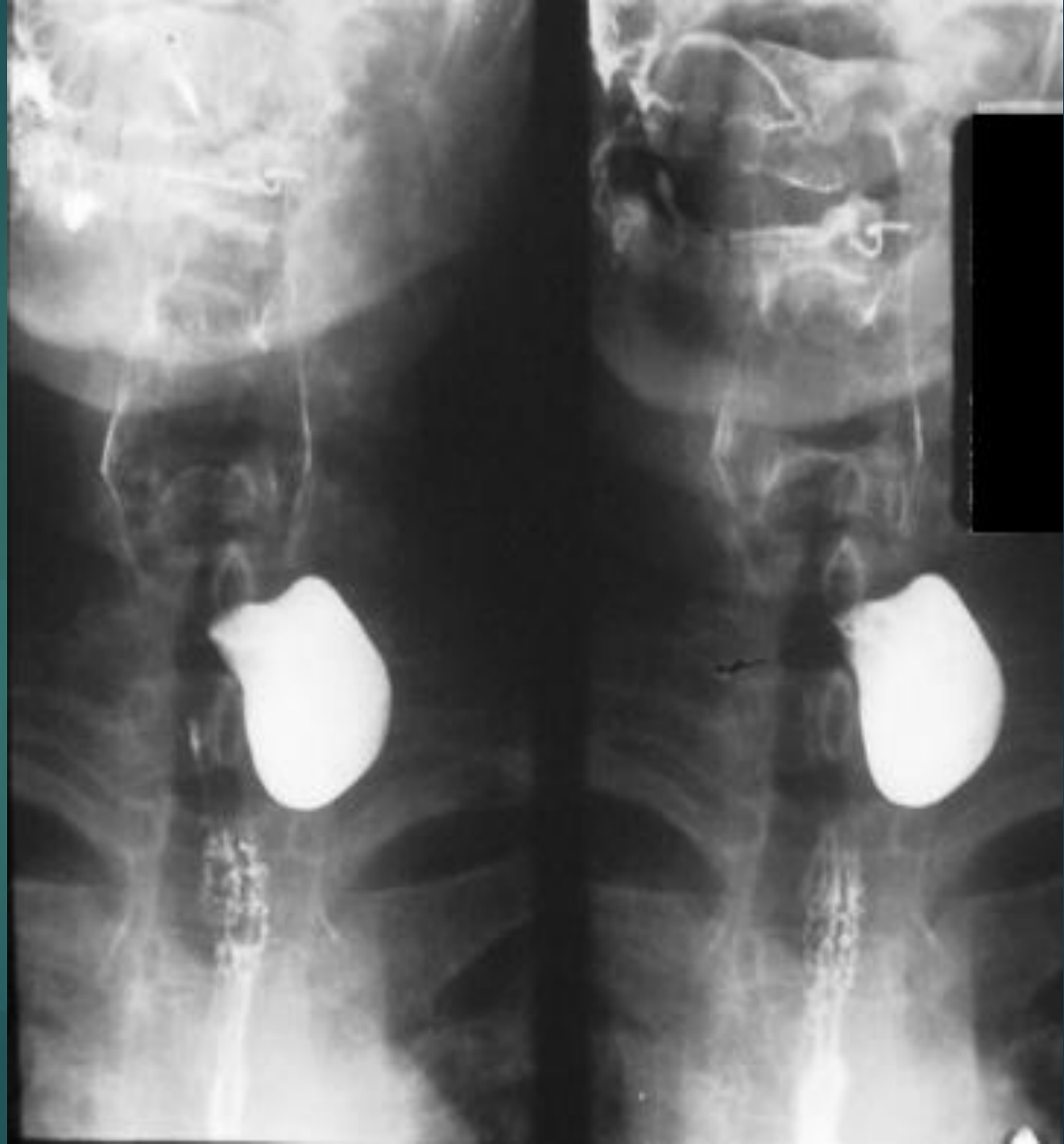






- A Zenker's diverticulum is also called pharyngeal pouch, pharyngoesophageal diverticulum, hypopharyngeal diverticulum
- Is a diverticulum of the mucosa of the pharynx, just above the cricopharyngeal muscle (i.e. above the upper sphincter of the esophagus).
- It is a pseudo diverticulum (not involving all layers of the esophageal wall).
- When there is excessive pressure within the lower pharynx, the weakest portion of the pharyngeal wall balloons out, forming a diverticulum which may reach several centimetres in diameter.

Zenker's diverticulum

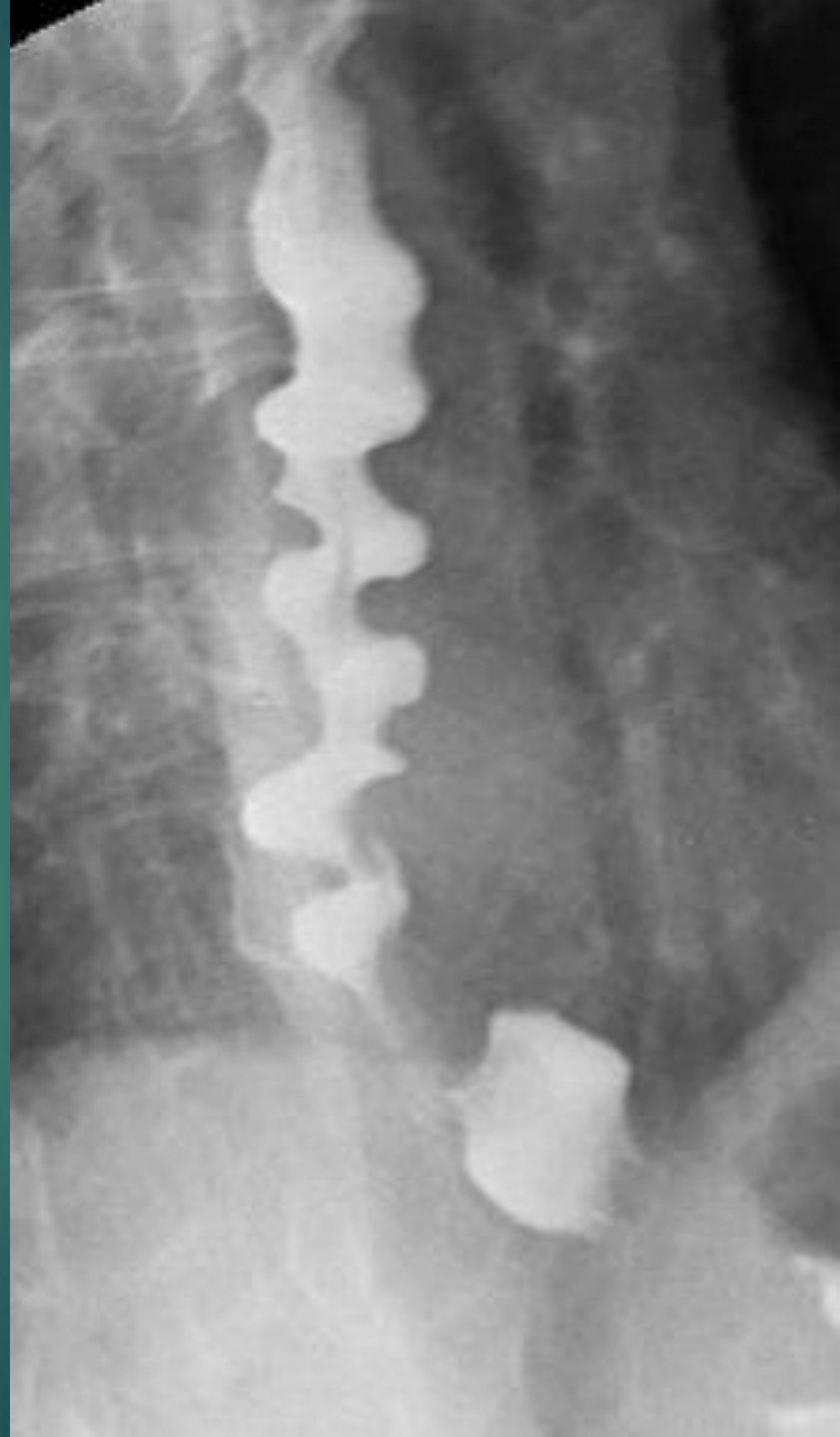


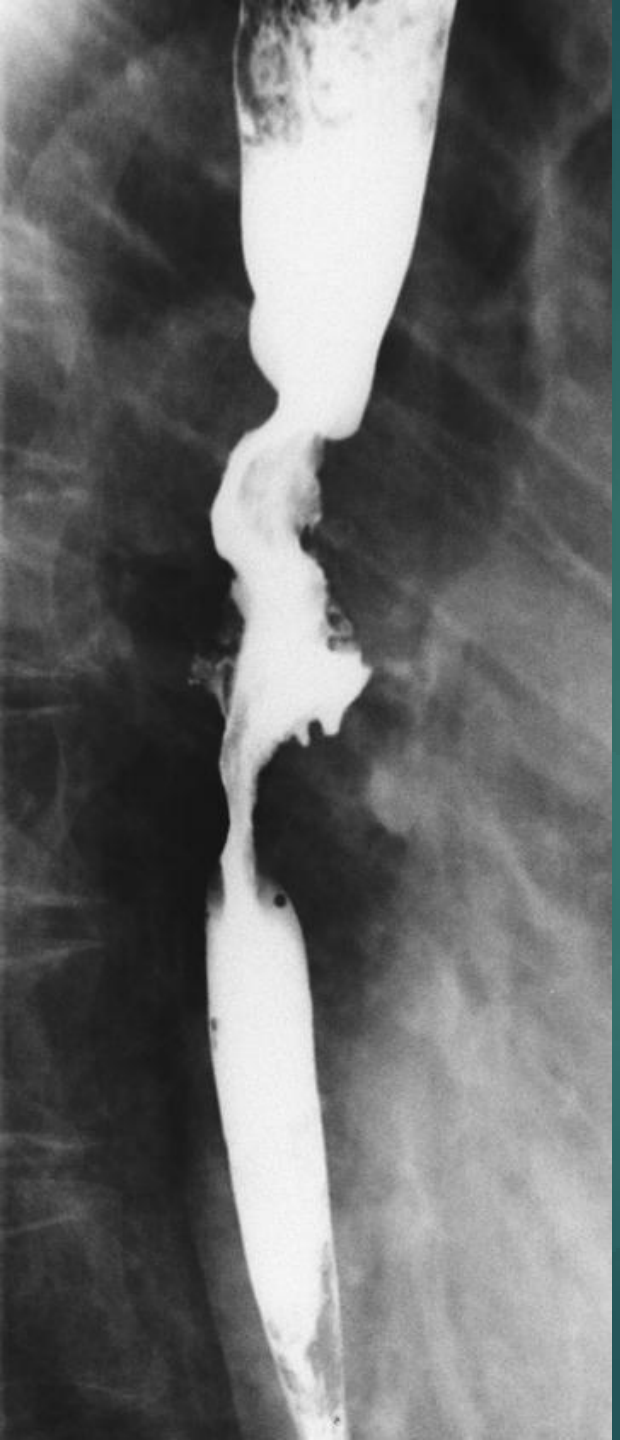
Diffuse esophageal spasm

- uncoordinated contractions where several sections of the esophagus can contract at once
- the food gets stuck into esophagus and cannot reach the stomach.
- On barium imaging commonly presentsas as a "***corkscrew esophagus***" or "***rosary bead***" appearance

Corkscrew

Rosary beads



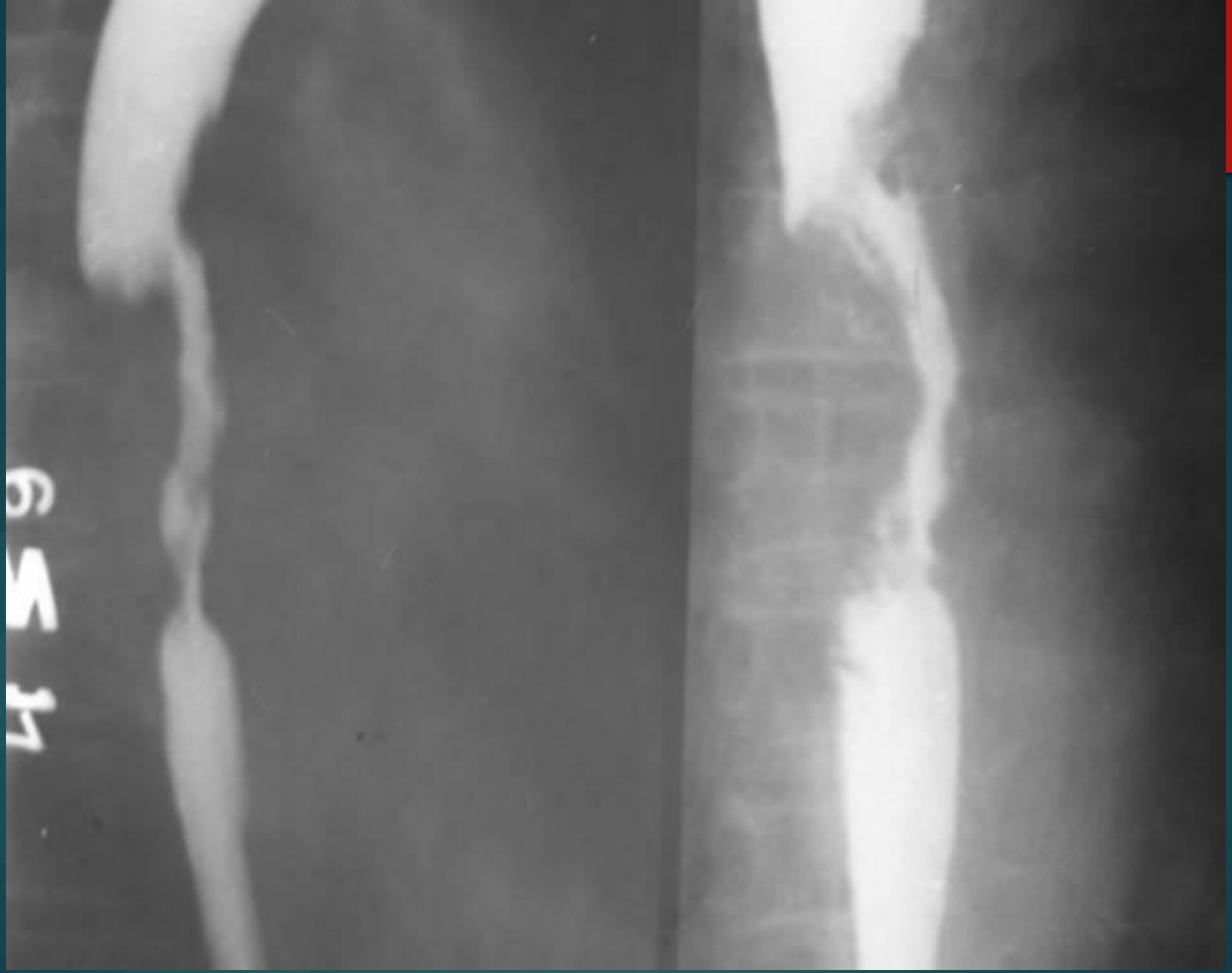


Esophageal carcinoma

A barium swallow demonstrates a very extensive, 9 cm long stricture and exophytic mass involving the middle third of the esophagus.

The relative lack of proximal esophageal dilatation is typical of carcinoma.

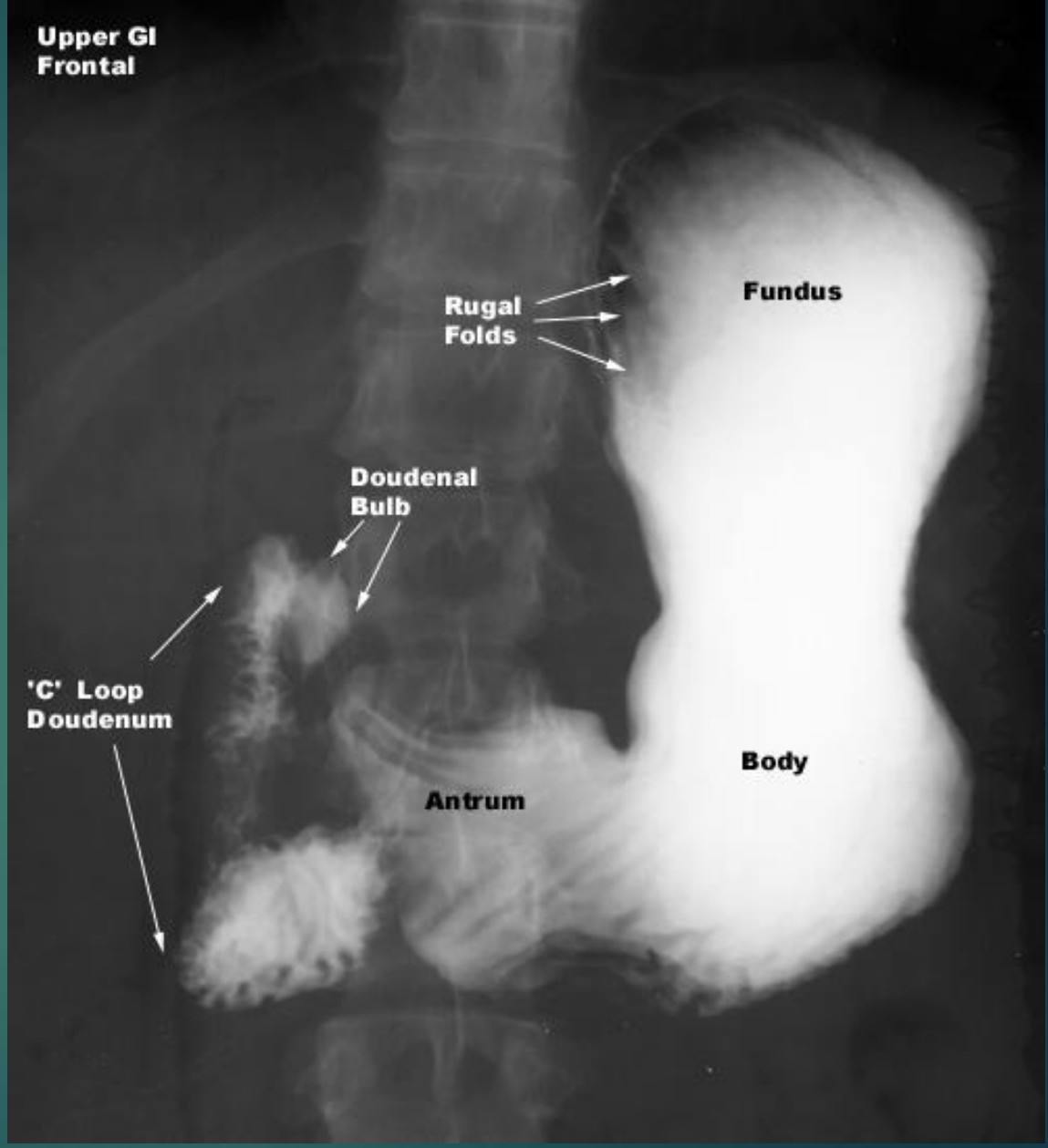
Although this method clearly detects the primary lesion, it is of no value in staging the disease.



Carcinoma of esophagus - a barium swallow showing irregular narrowing with "shouldered edges" suggestive of a malignant

Barium study of the stomach

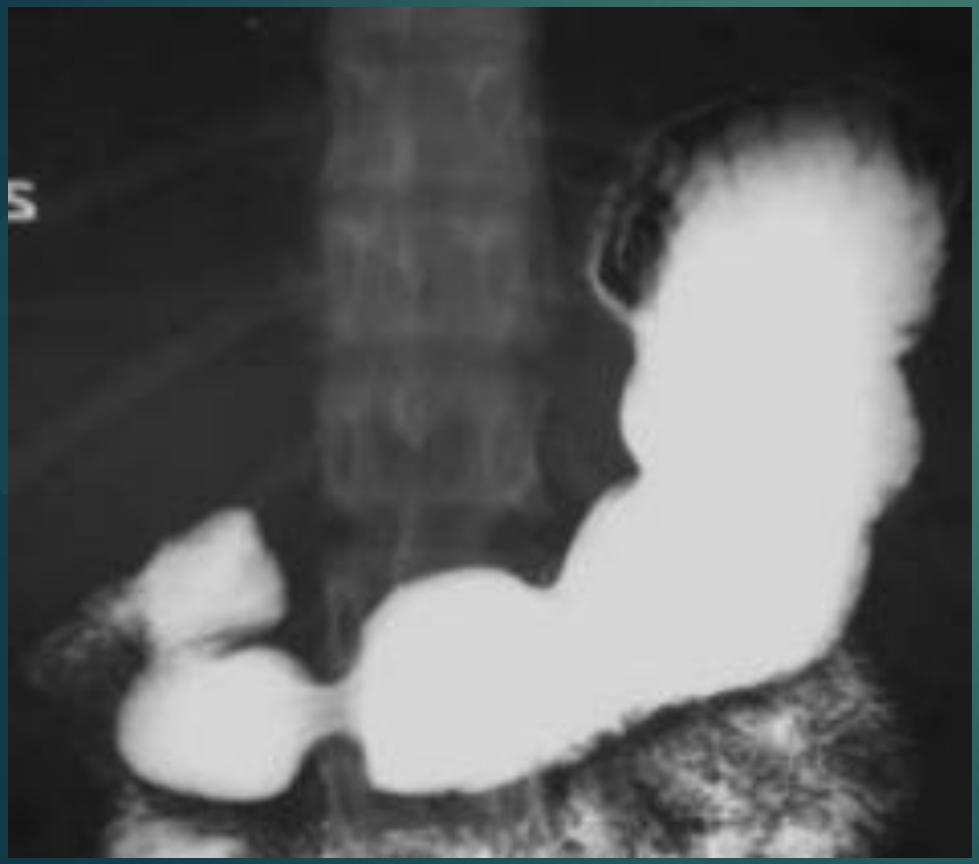
Location, shape and size of the stomach are usual. The stomach doesn't contain food rests or excessive amount of gastric juice. In its anatomical and functional characteristics the stomach corresponds to the normostenic constitutional type. The contours of the stomach along the lesser curvature are regular, distinct; along the greater curvature – uniformly serrated. The folds of the mucous membrane are not modified. *If your discover any modification, fix it (ex. Defect of the contour plus filling (niche) at the lsser curvature etc).*



Source: http://www.rad.msu.edu/Course/Rad_intro/X-Rays/X-Ray_Examples/Abdomen/abdomen.html

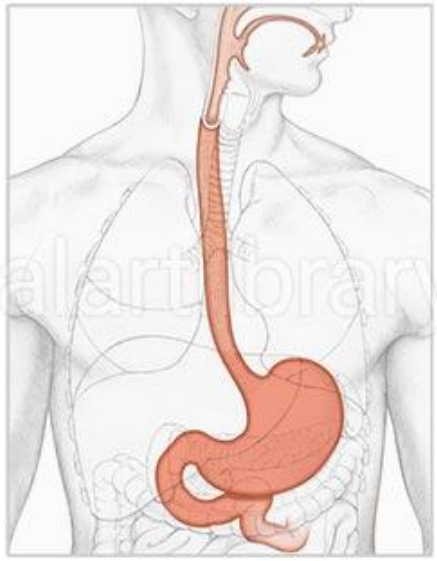
Barium study of the stomach

- Single contast Barium study of the stomach – uses only barium sulfate.
- Double contrast Barium study of the stomach – uses barium sulfate and a negative contrast agent (such as air, nitrogen or carbon dioxide) for a better visualization of gastric mucosa and small mucosal lesions.



Single contrast

Double contrast



esophagus

LES
lower esophageal
sphincter

fundus

cardia

Z line

lesser
curvature

rugae

pyloric
sphincter

duodenum

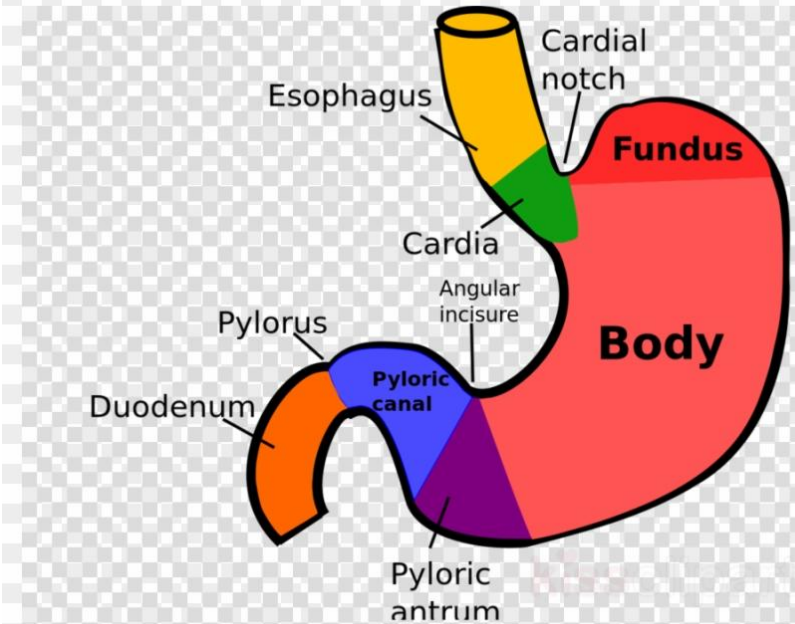
body

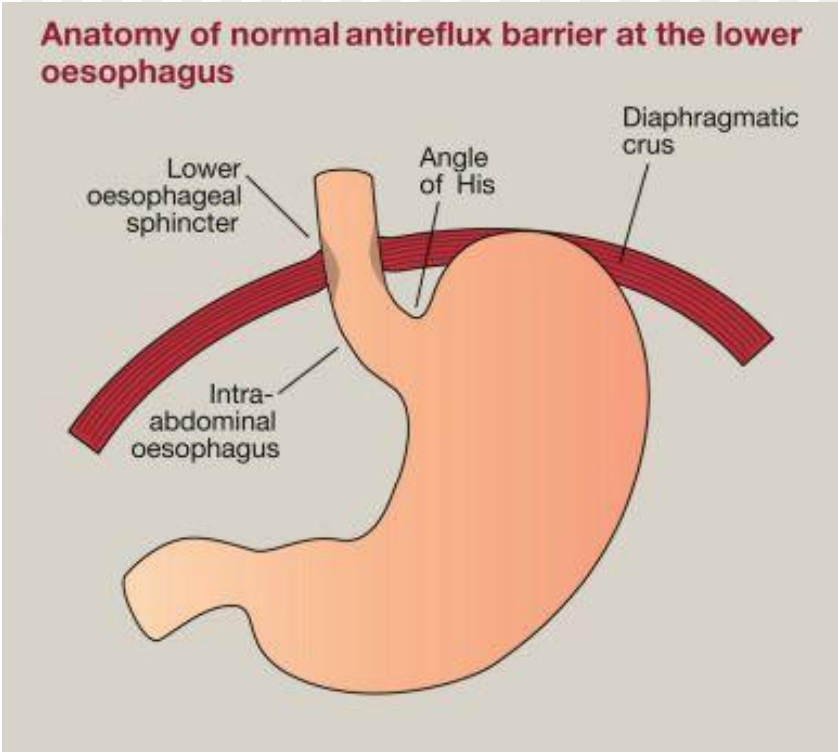
pylorus

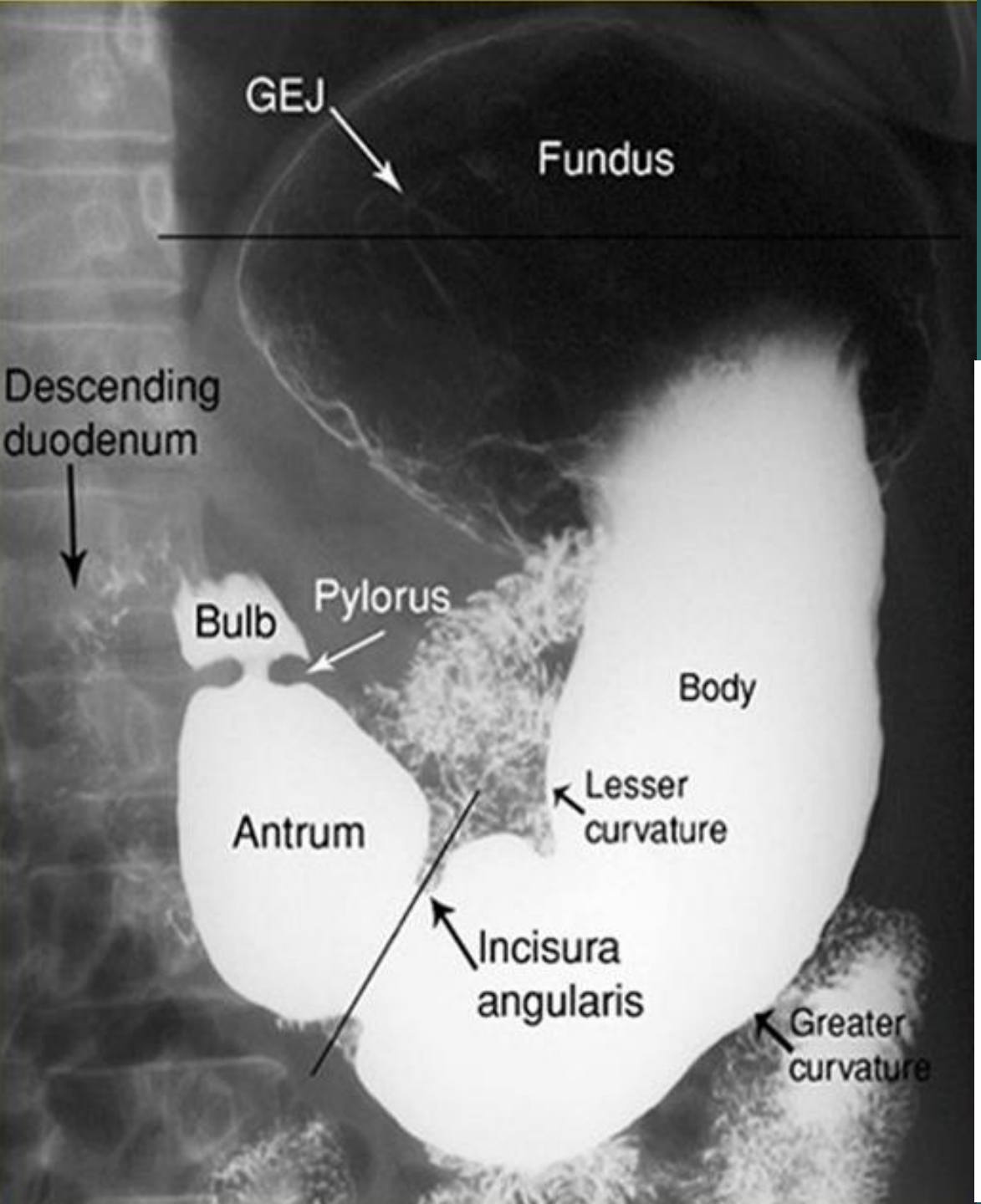
stomach

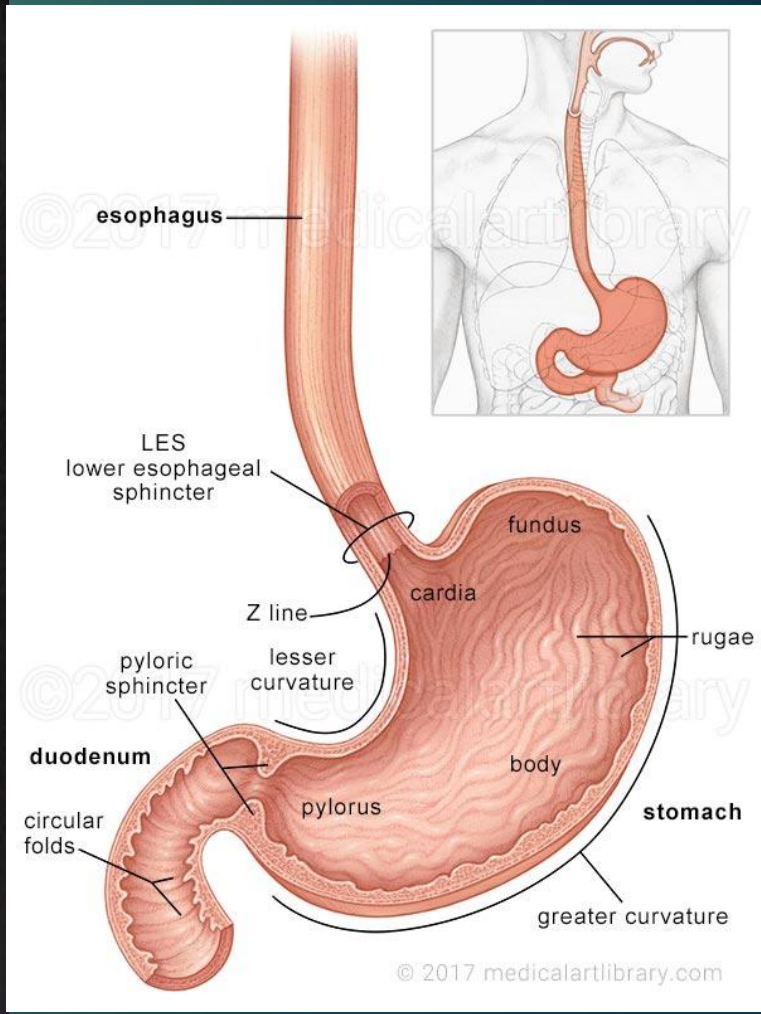
circular
folds

greater curvature






GEJ
Fundus
Descending duodenum
Bulb
Pylorus
Body
Antrum
Lesser curvature
Incisura angularis
Greater curvature


esophagus
LES
lower esophageal sphincter
fundus
cardia
Z line
rugae
pyloric sphincter
lesser curvature
duodenum
body
pylorus
stomach
circular folds
greater curvature
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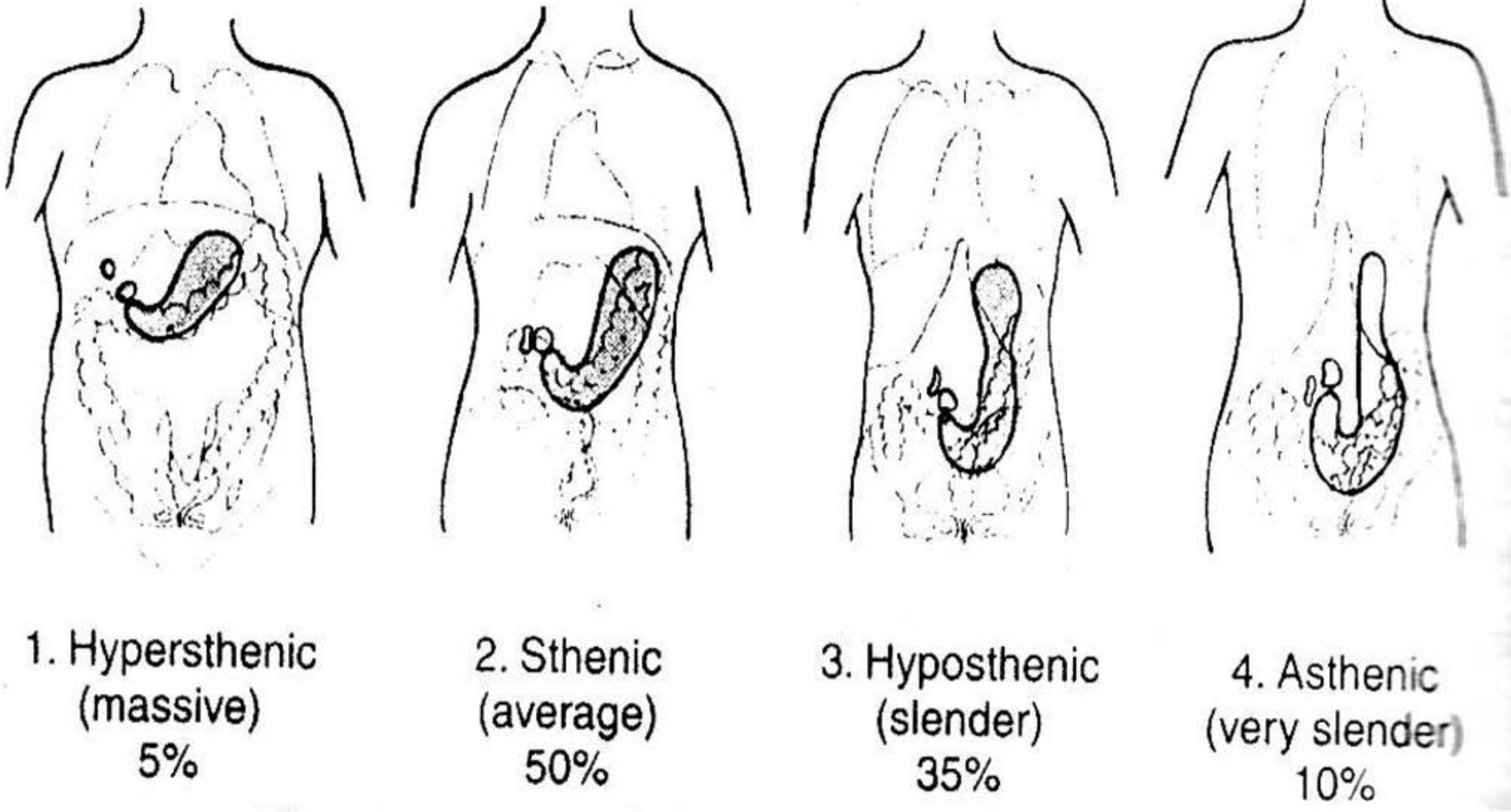


Source: http://catatanradiograf.blogspot.com/2010/03/teknik-radiografi-omd-oesophagus-maag.html

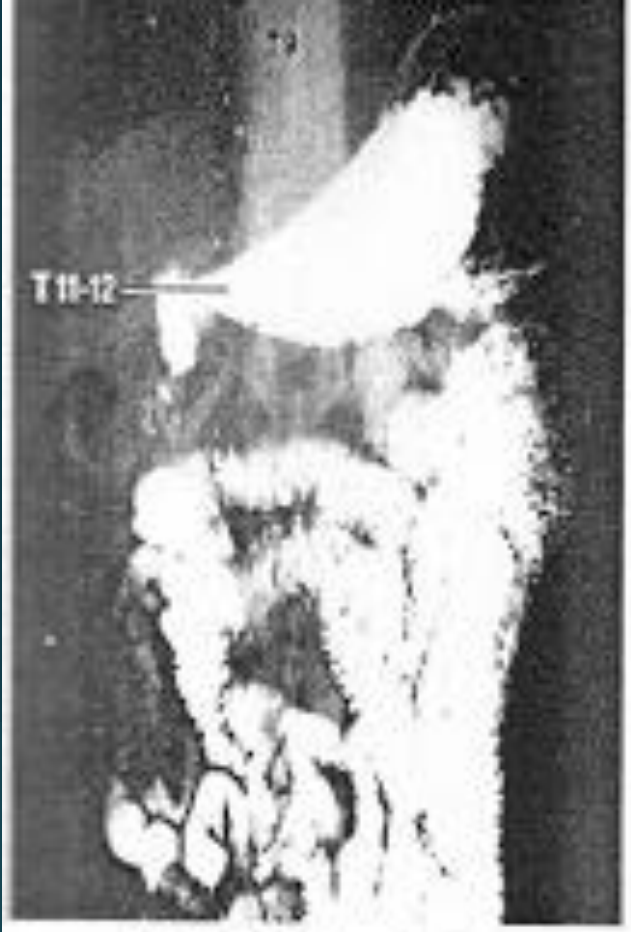


Fig. 14-26. Hypersthenic.
General stomach–high and transverse, level [illegible] to T12.
Pyloric portion–level of T11 to T12, at midline.
Duodenal bulb location–level of T11 to T12, [illegible] of midline.

Fig. 14-27. Sthenic.
General stomach–level T10 to L2.
Pyloric portion–level of L2, near midline.
Duodenal bulb location–level of L2, near midline.

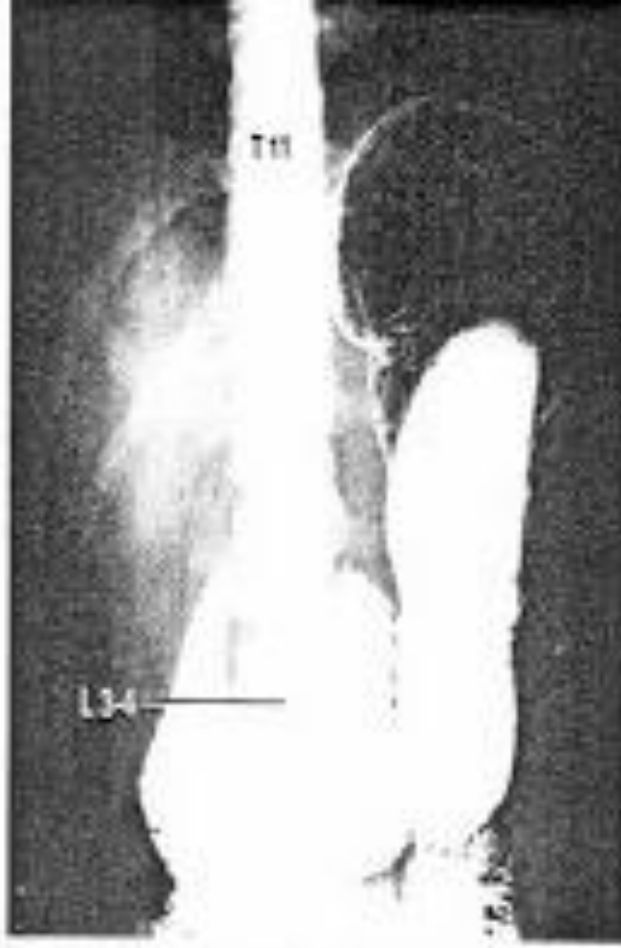
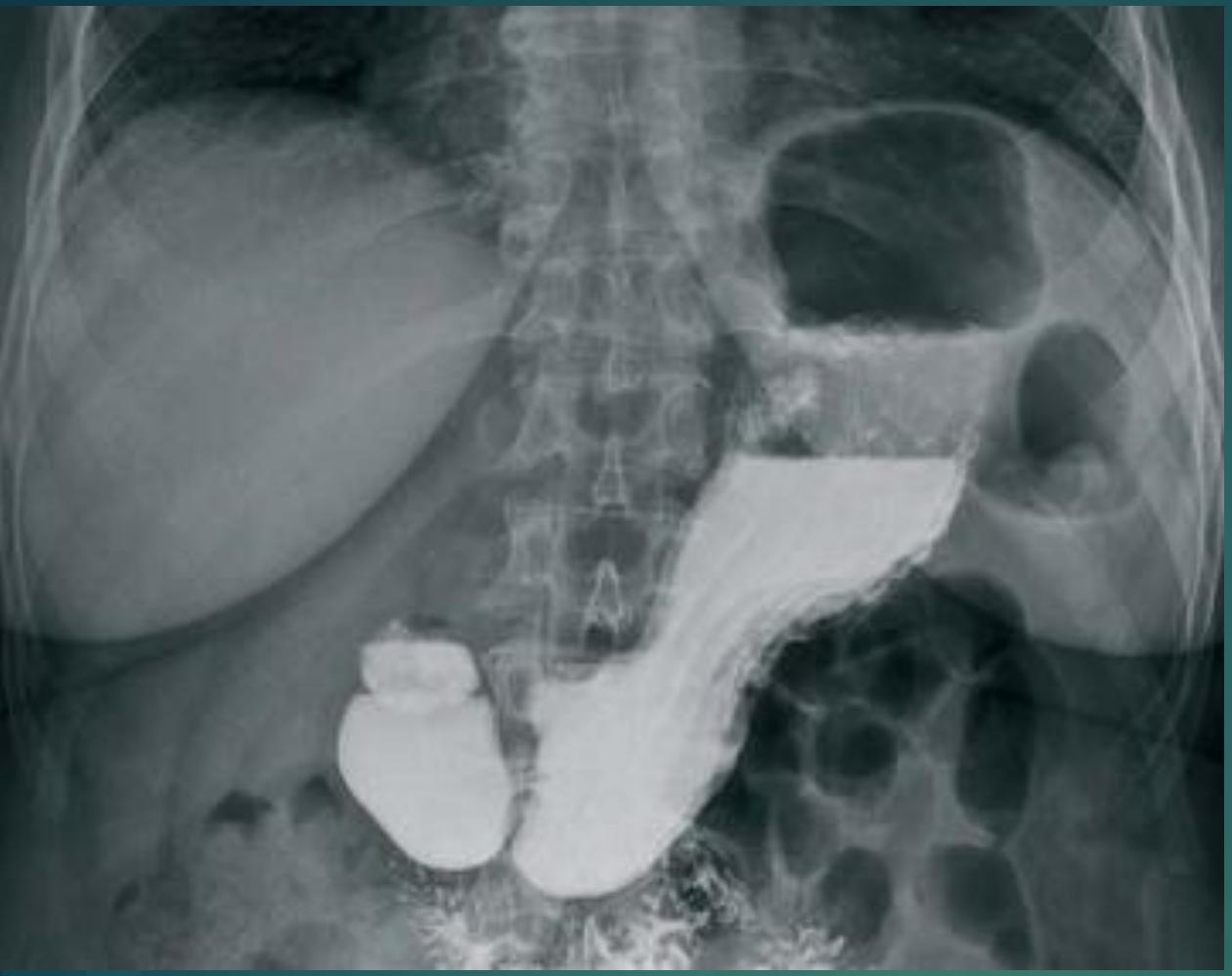
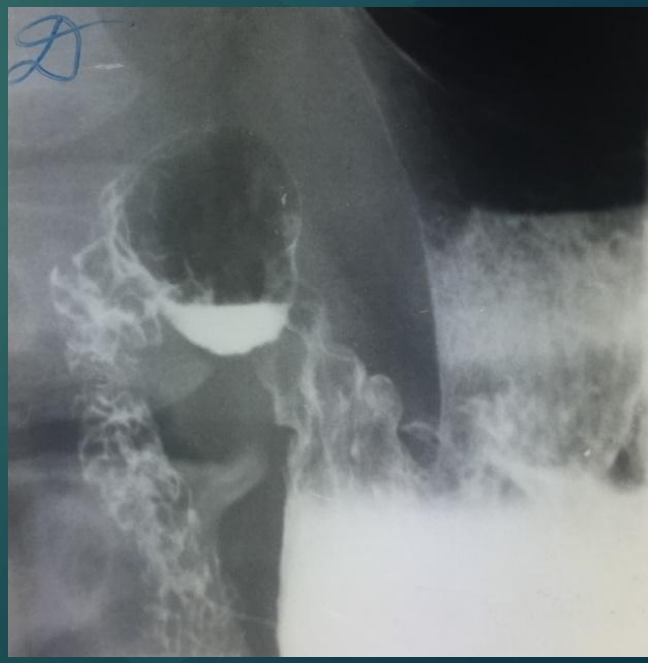


Fig. 14-28. Asthenic.
General stomach–low and vertical, level T11 to L4.
Pyloric portion–level of L3 to L4, to left of midline.
Duodenal bulb location–level of L3, at midline.

Source: http://catatanradiograf.blogspot.com/2010/03/teknik-radiografi-omd-oesophagus-maag.html

Gastritis





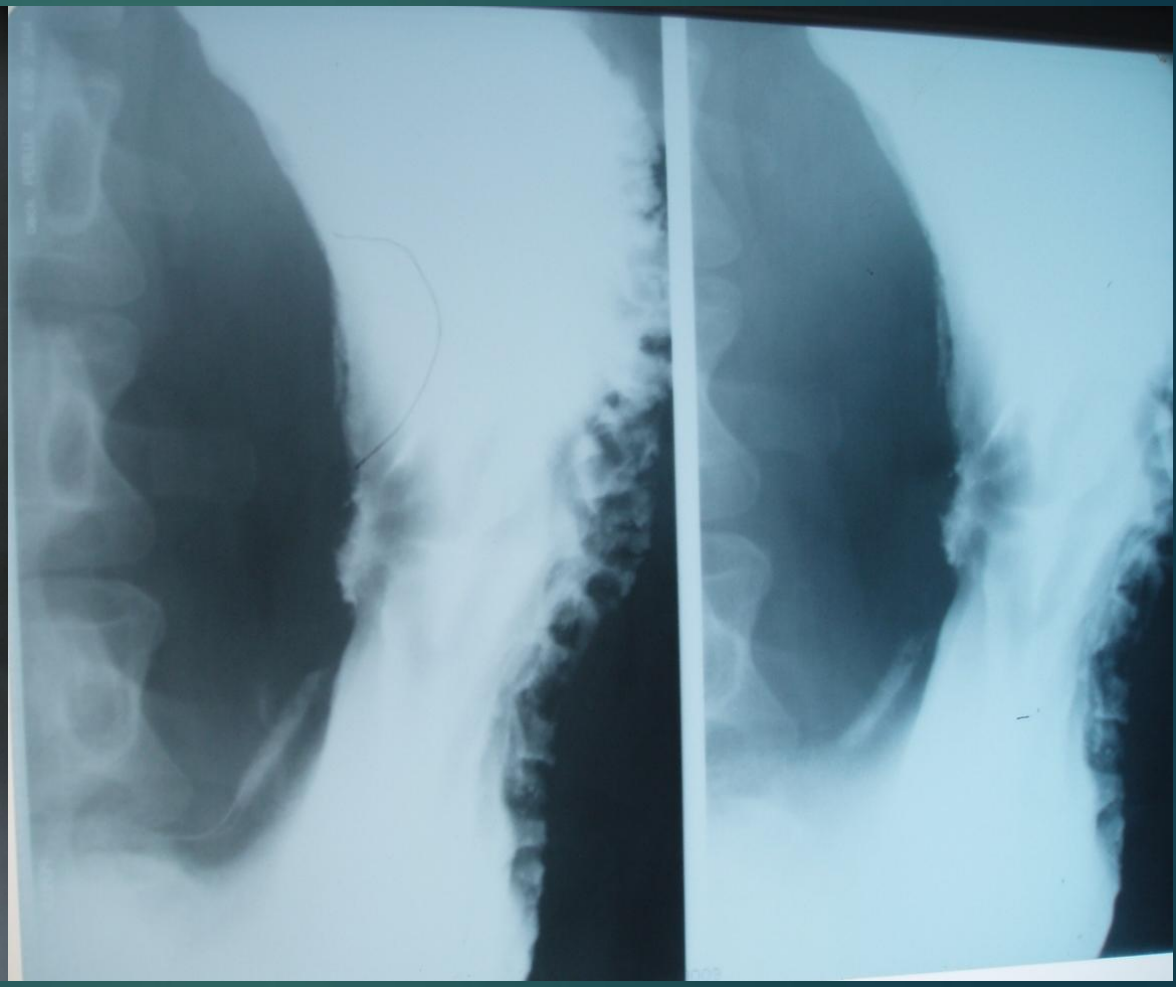
3 levels on Barium studies:

- air
- mucus
- Barium

Gastric ulcers

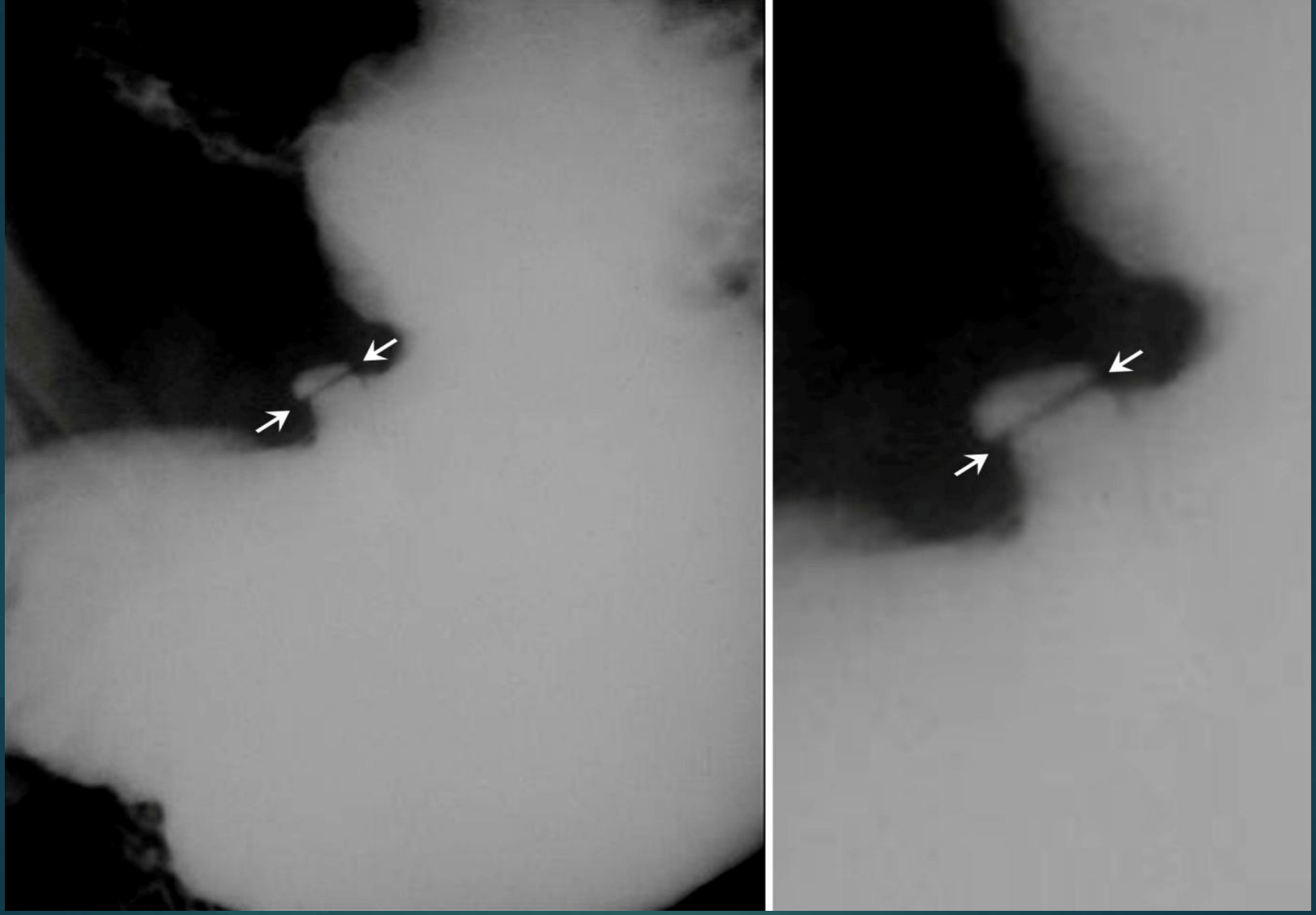
RADIOLOGICAL SIGN ON BARIUM STUDIES

- Niche



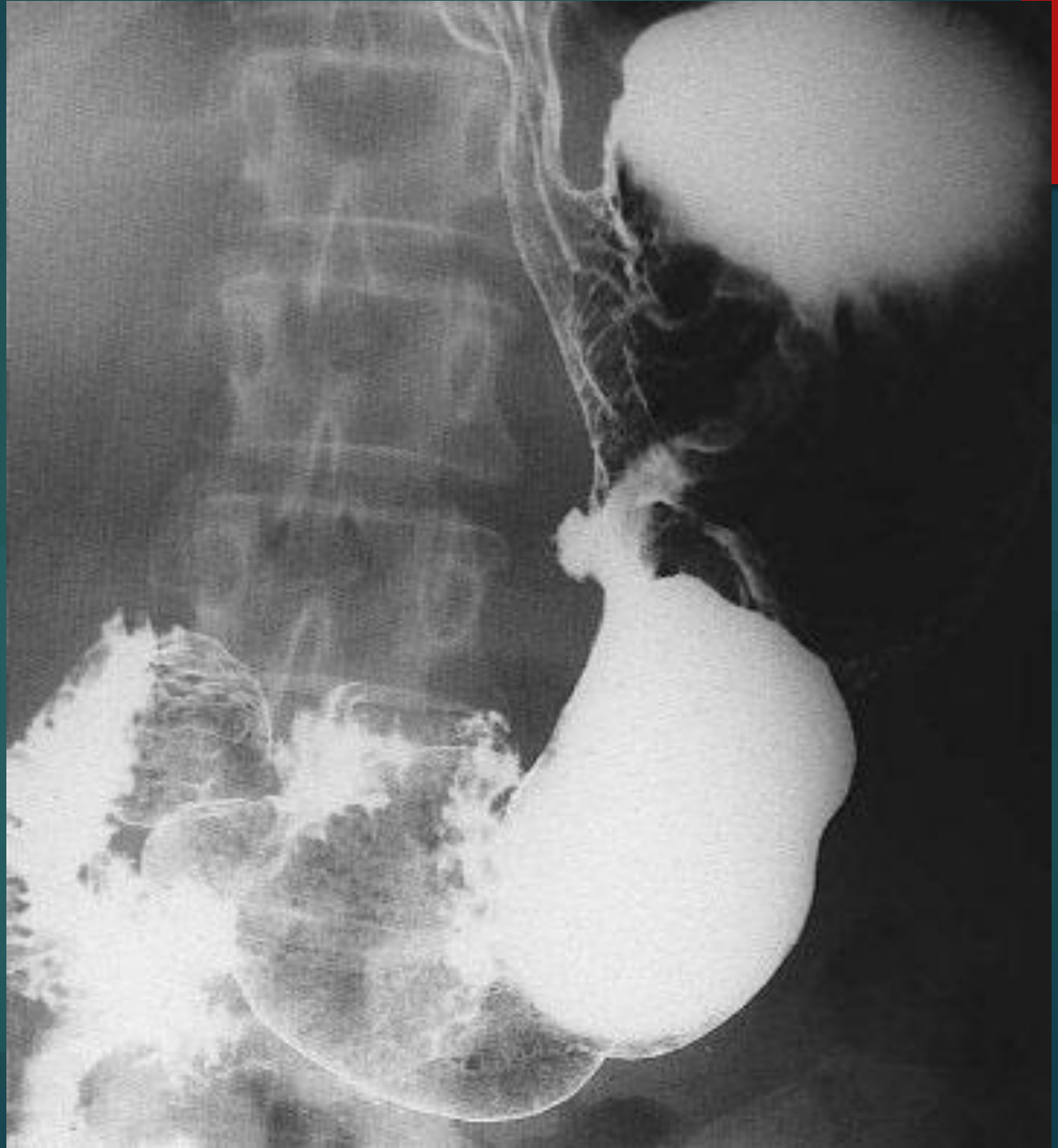
Gastric ulcers

Benign gastric ulcer

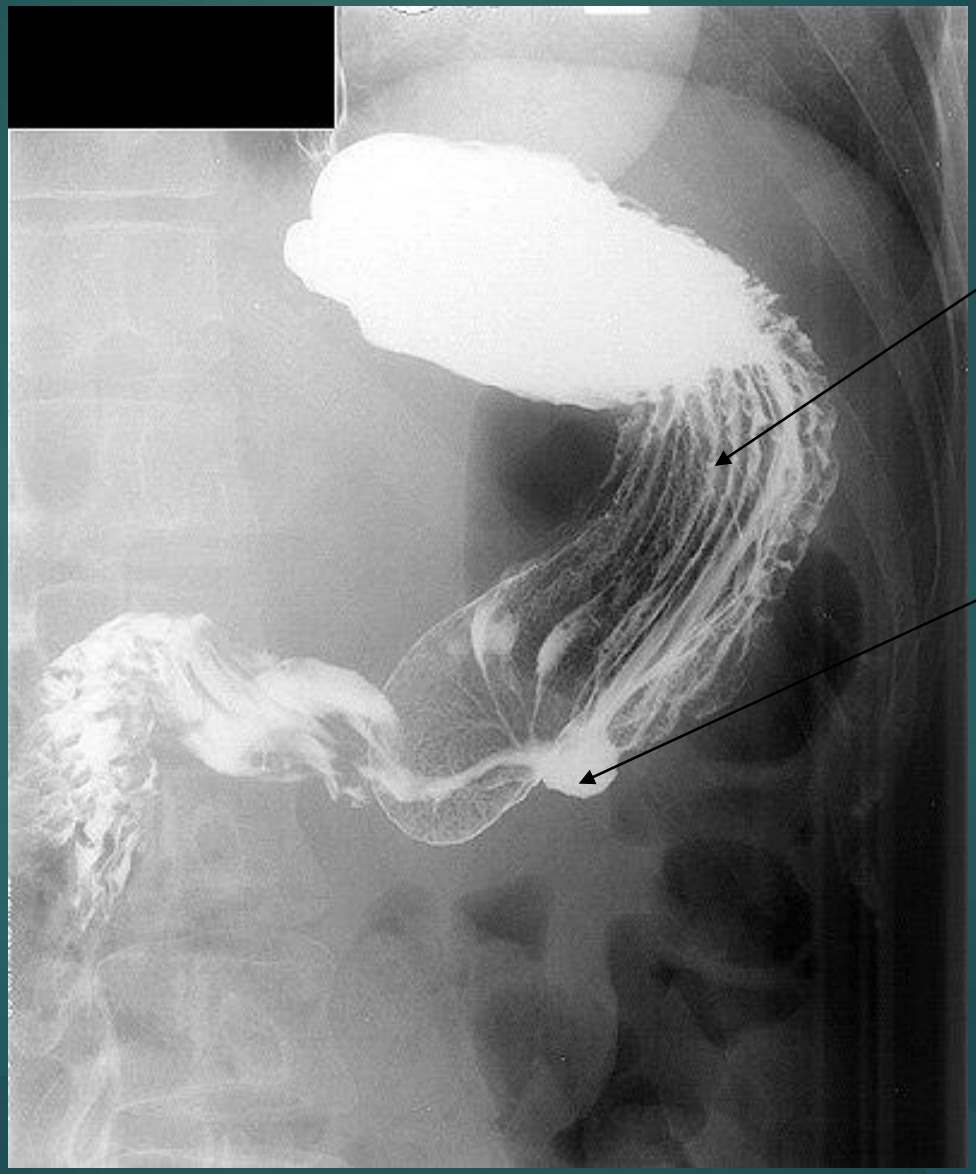


Humpton's line (benign gastric ulcer)

There is a filling excess with smooth outlines on the lesser curvature, with a spasm pointing to the ulcer on the opposite, greater curvature (functional sand-glass stomach).



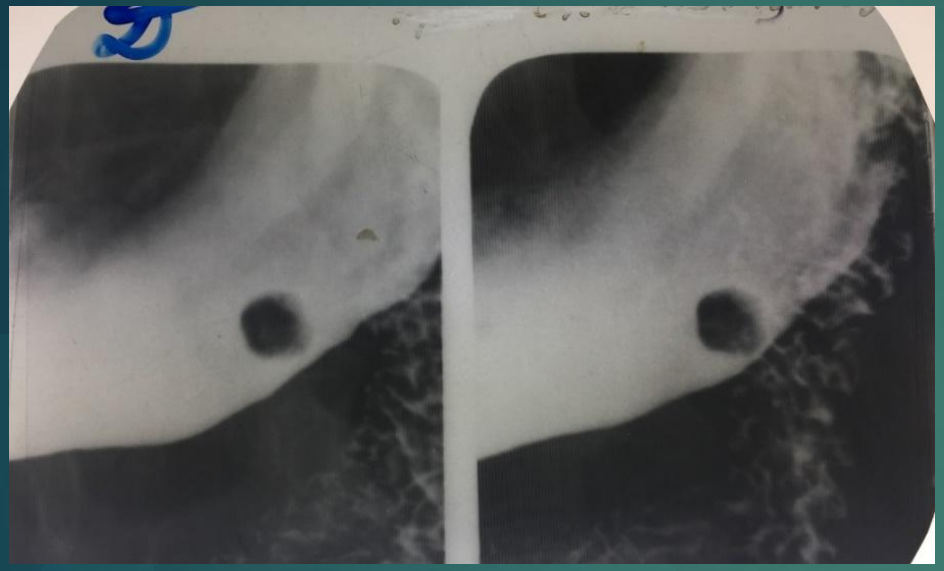
Barium study of the stomach, Double Contrast



BENIGN GASTRIC TUMORS

RADIOLOGICAL SIGN ON BARIUM STUDIES

- Lacuna

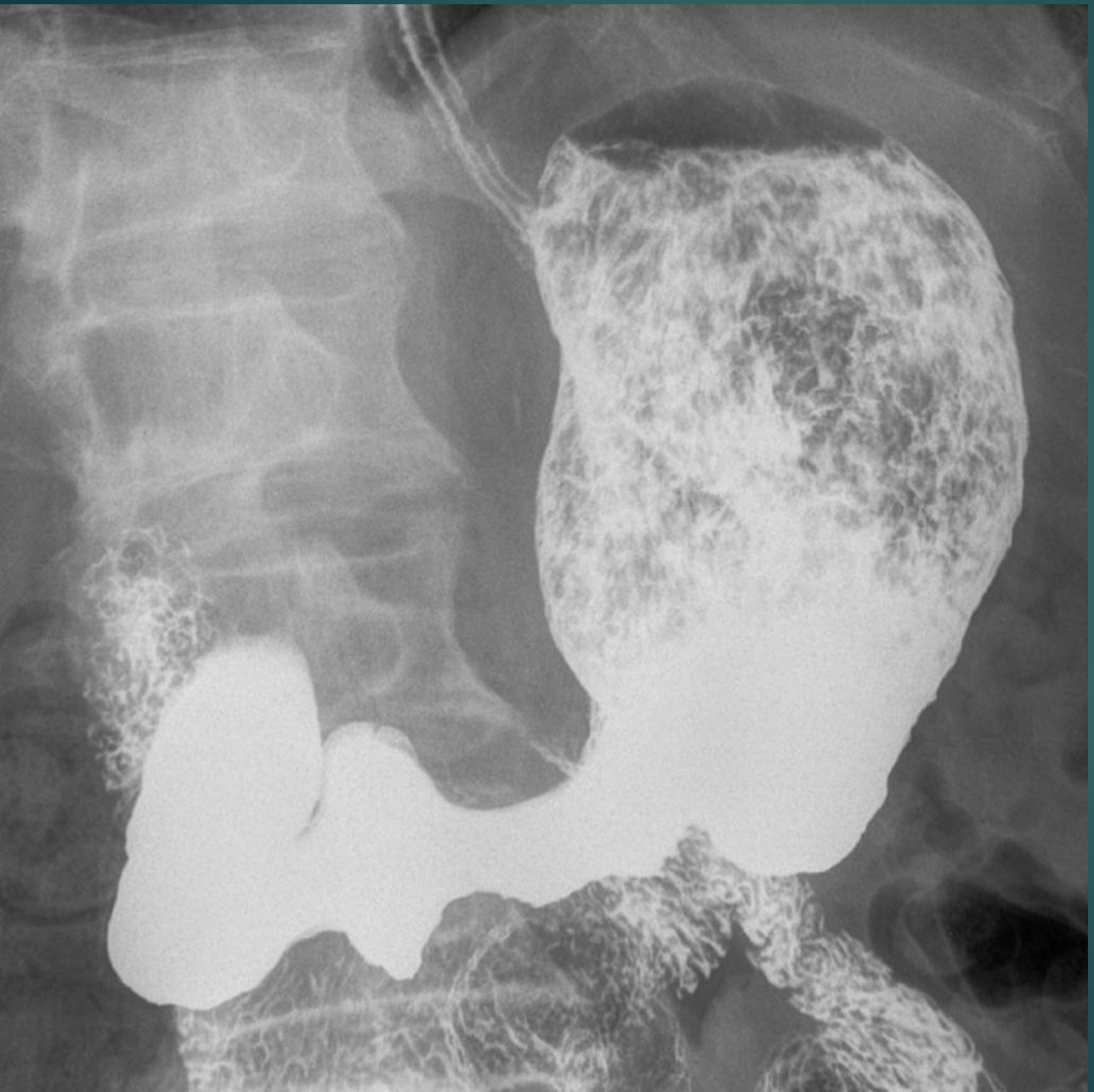


Barium study of the stomach

Gastric polyp

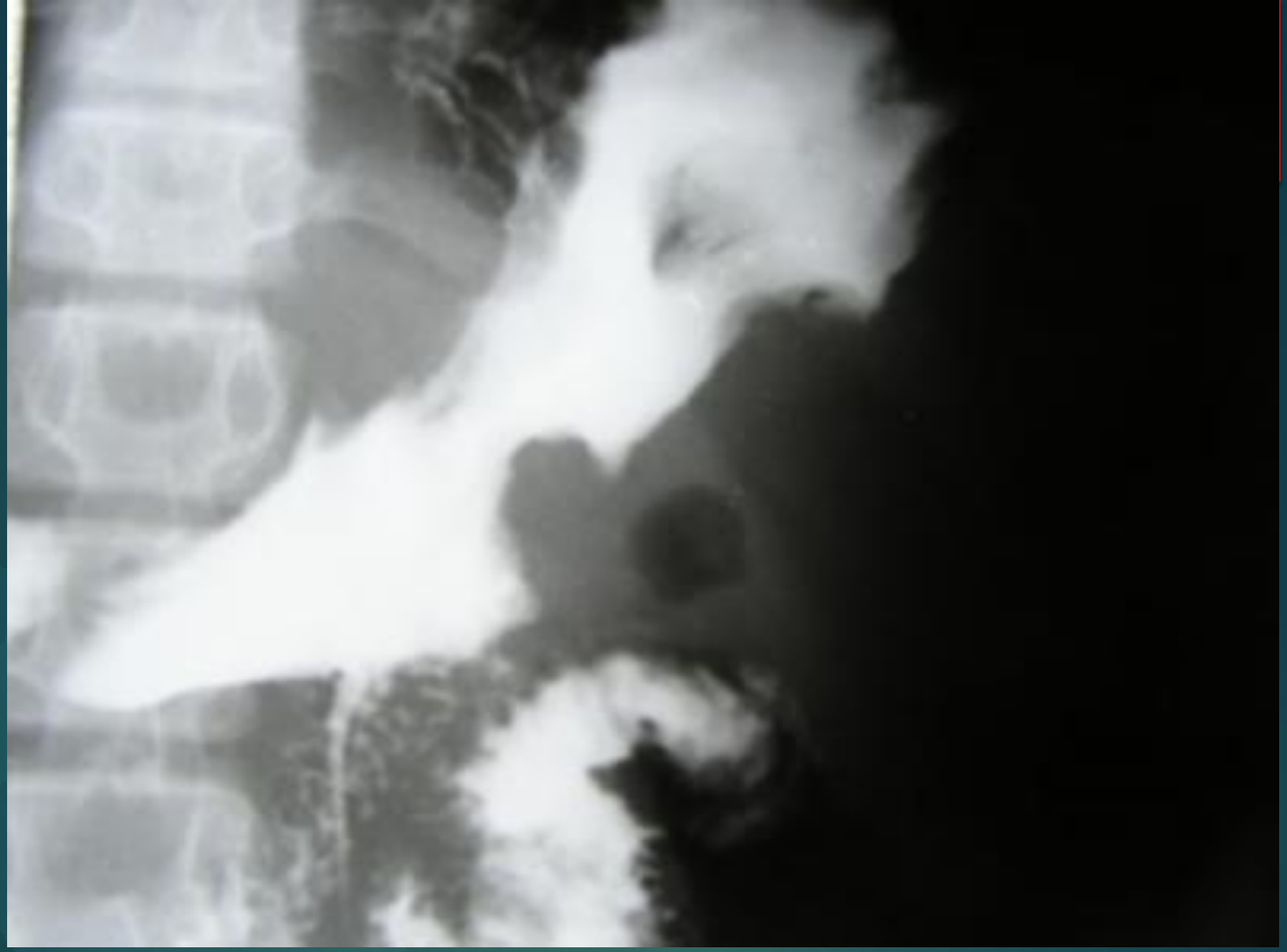
Gastric diverticulum

MALIGNANT GASTRIC TUMORS



Gastric adenocarcinoma

Irregular stenosis with rigidity of the greater curvature of the stomach at prepyloric gastric antrum.



Gastric Adenocarcinoma.

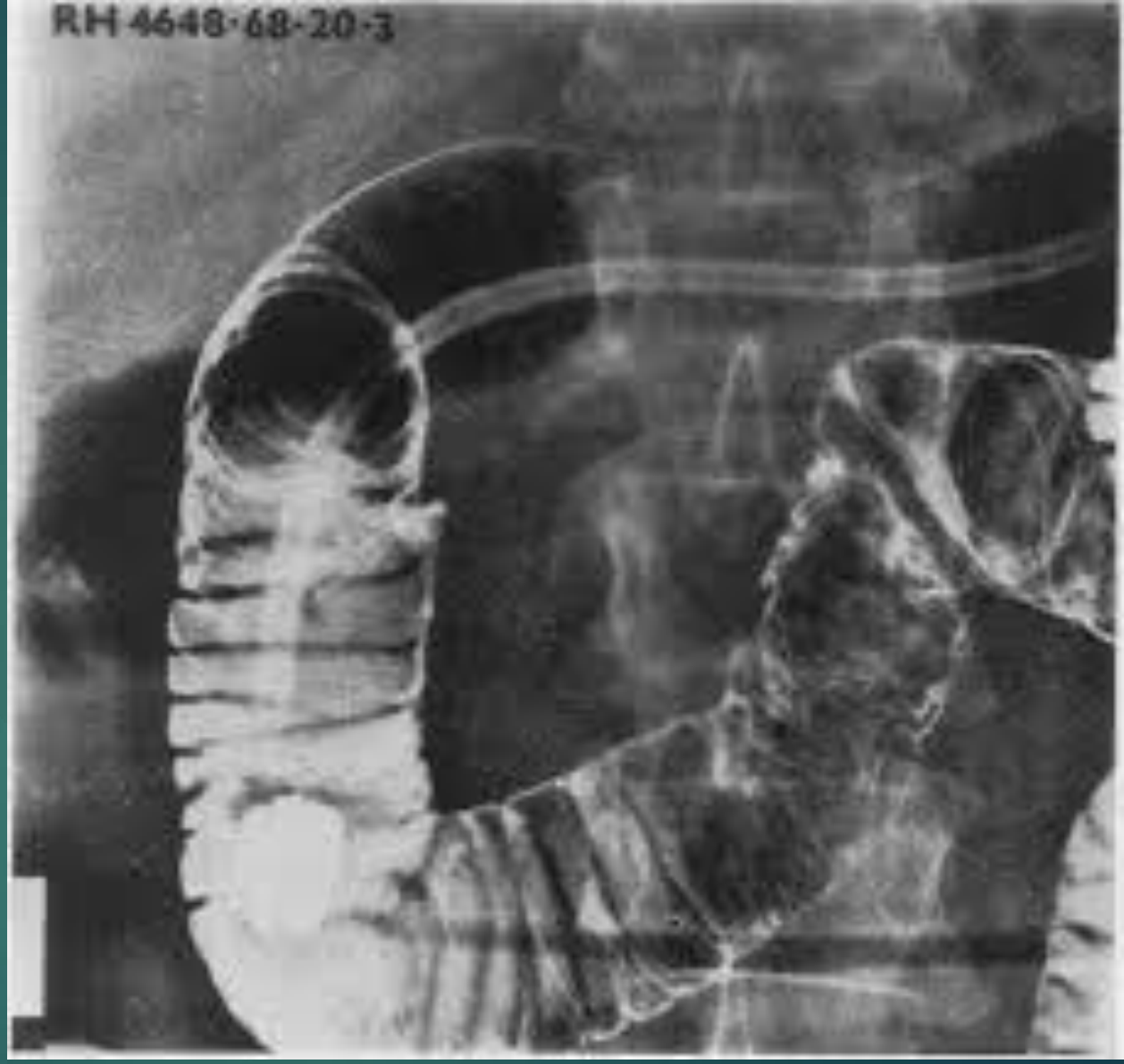
Barium studies large irregular lobulated mass in the body of stomach.

Diaphragmatic hernia

Barium study of the duodenum

The duodenal bulb is of usual location, shape and size, its contours are regular and are well-defined. The folds of the mucous membrane are usual. The postbulbar segments are not modified. The duodeno-jejunal flexure is not modified.

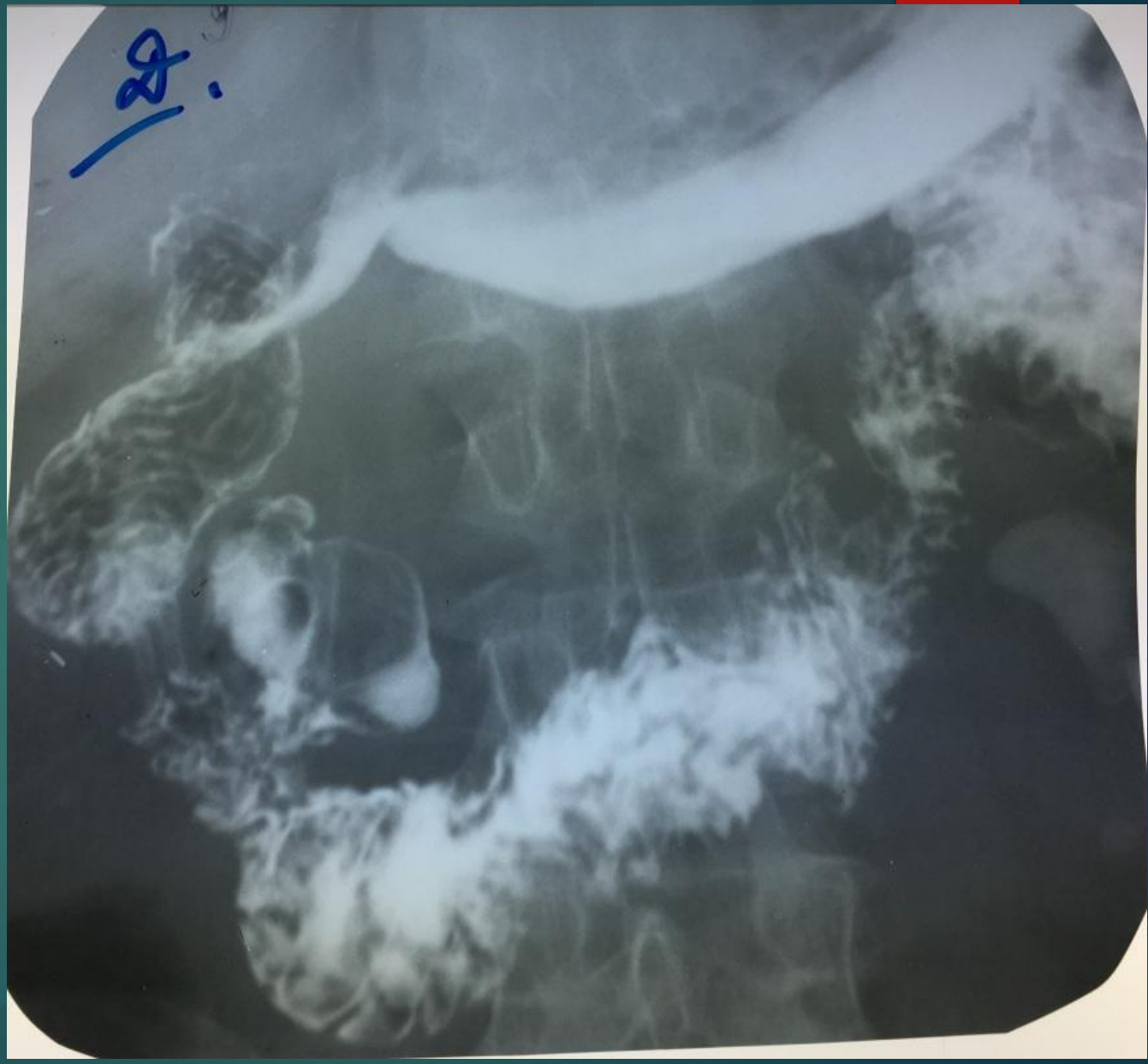
If your discover any modification, fix it.



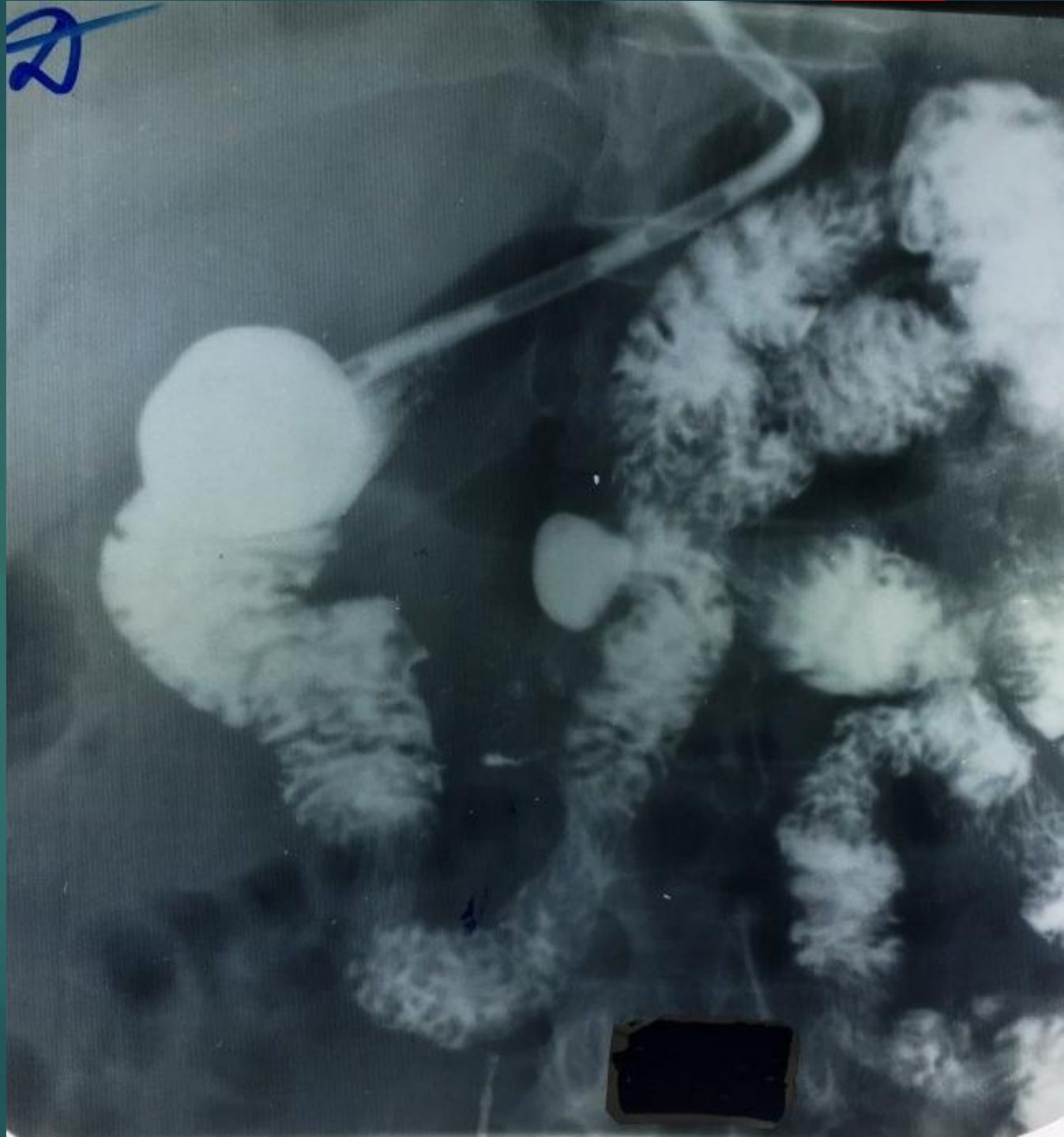
Hypotonic duodenography with double contrast

Image source: https://gut.bmj.com/content/gutjnl/10/6/428.full.pdf

Duodenal diverticulum in the descending (D2) part.



Duodenal diverticulum in the ascending (D4) part.



Duodenal ulcer

1st Part of duodenum

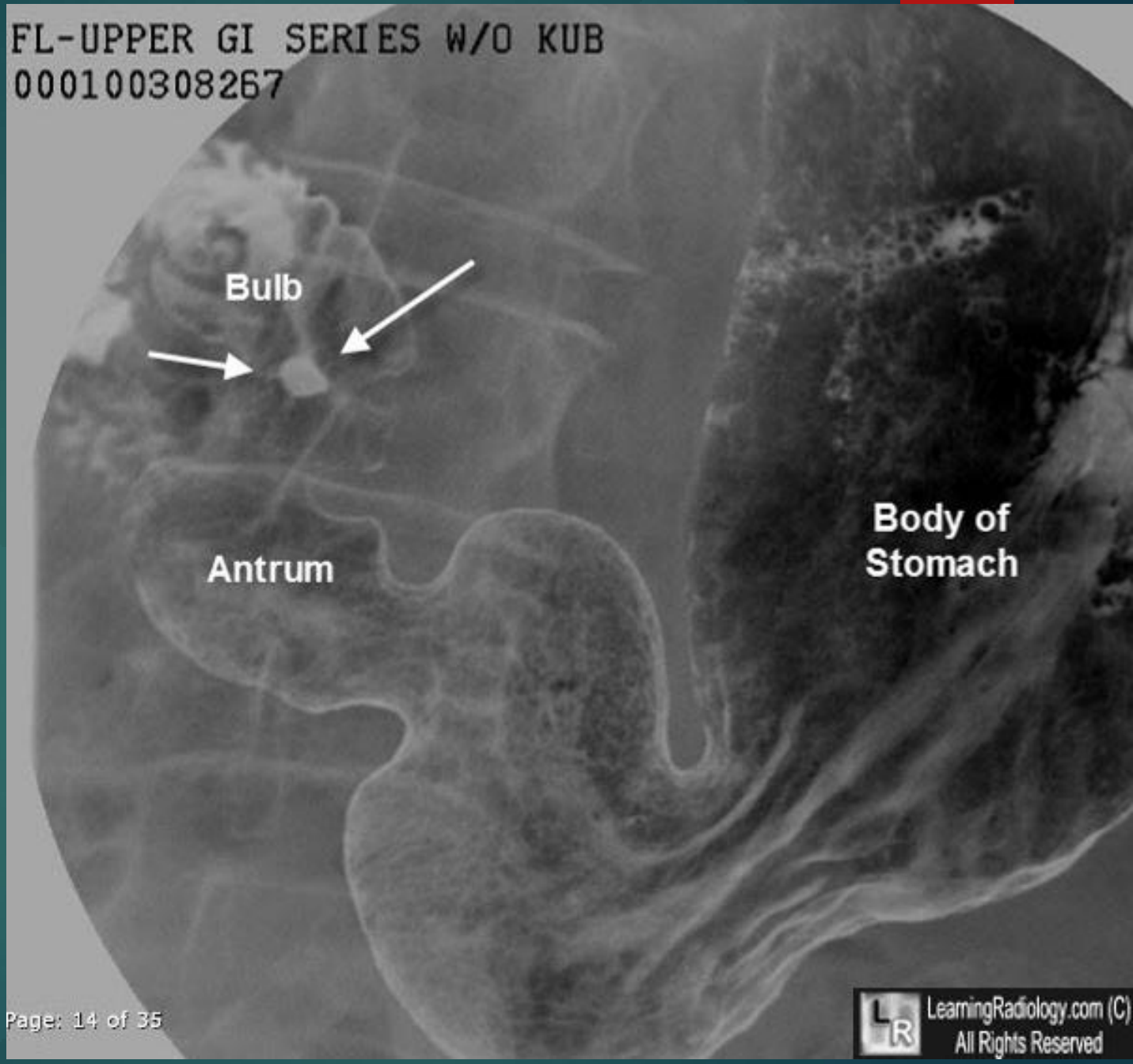
2nd Part of duodenum

3rd Part of duodenum

Contrast Filled Spiculated Lesion (Duodenal Ulcer)

4th Part of duodenum

Duodenal ulcer



Source: http://learningradiology.com/notes/ginotes/duodenalulcerpage.htm

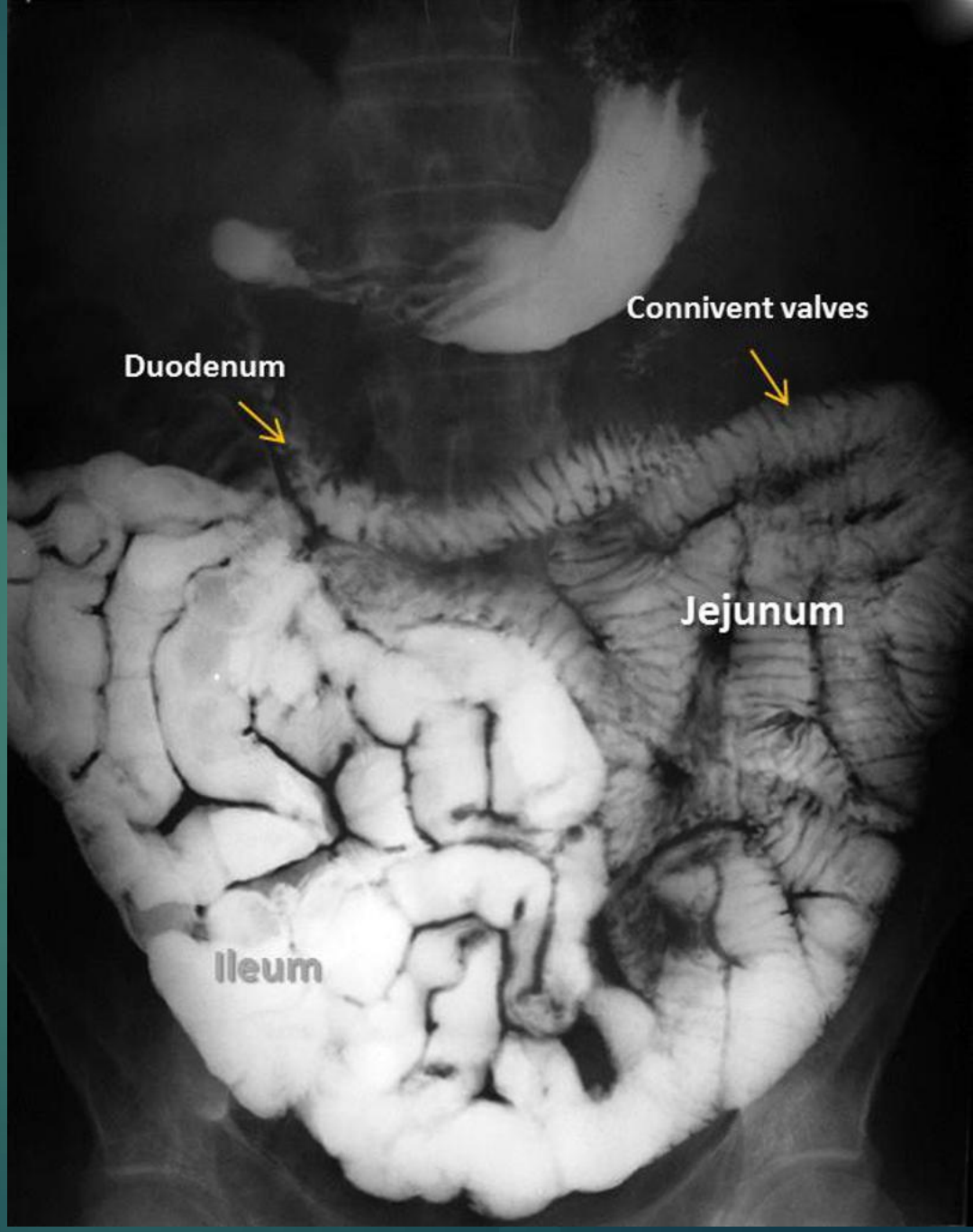
DUODENAL ATRESIA

„double-bubble" sign

Barium study of the small bowel

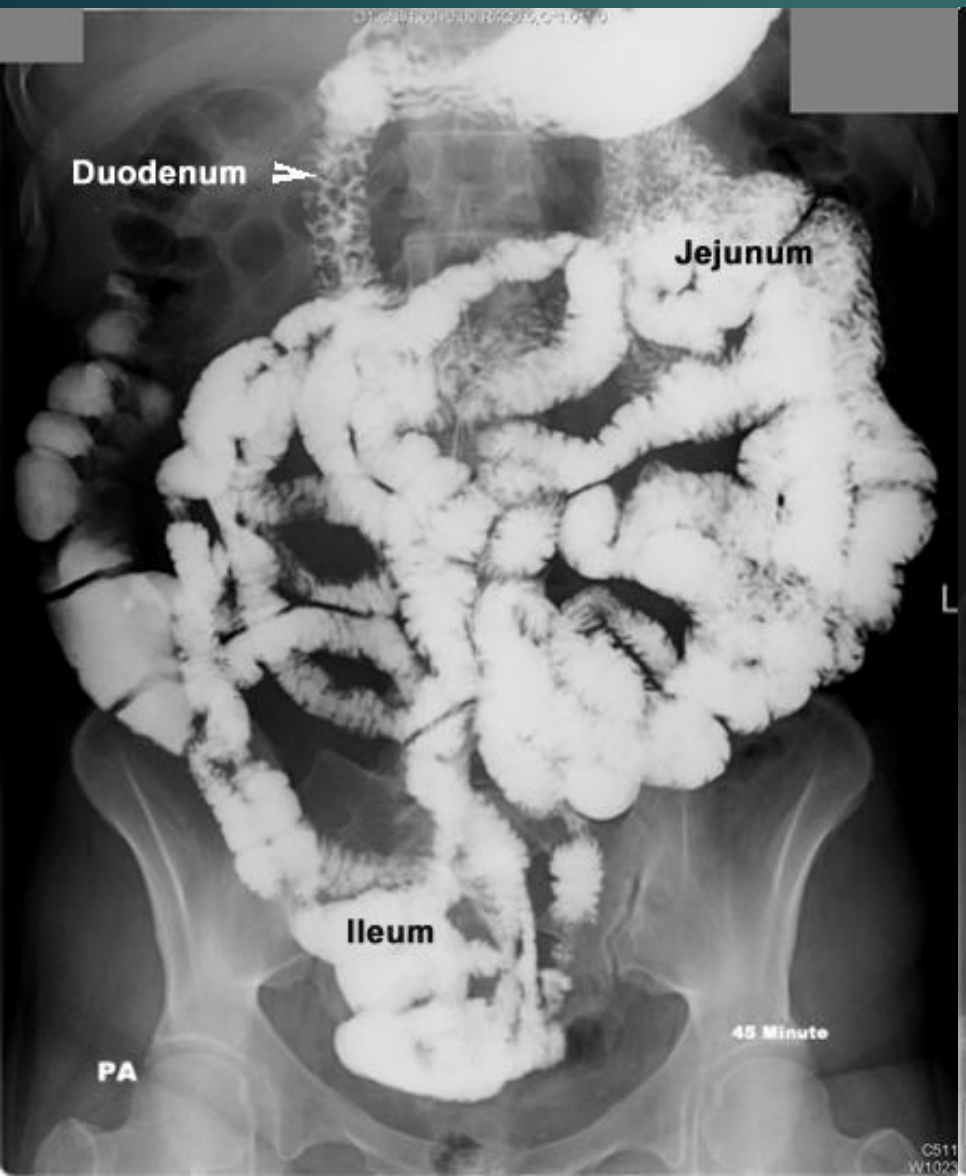
The contrastation is usual over a considerable distance, the folds of mucosa have a usual pattern.

If your discover any modification, fix it.



Source: https://radiopaedia.org/cases/small-bowel-barium-study-normal-pattern-1?lang=us

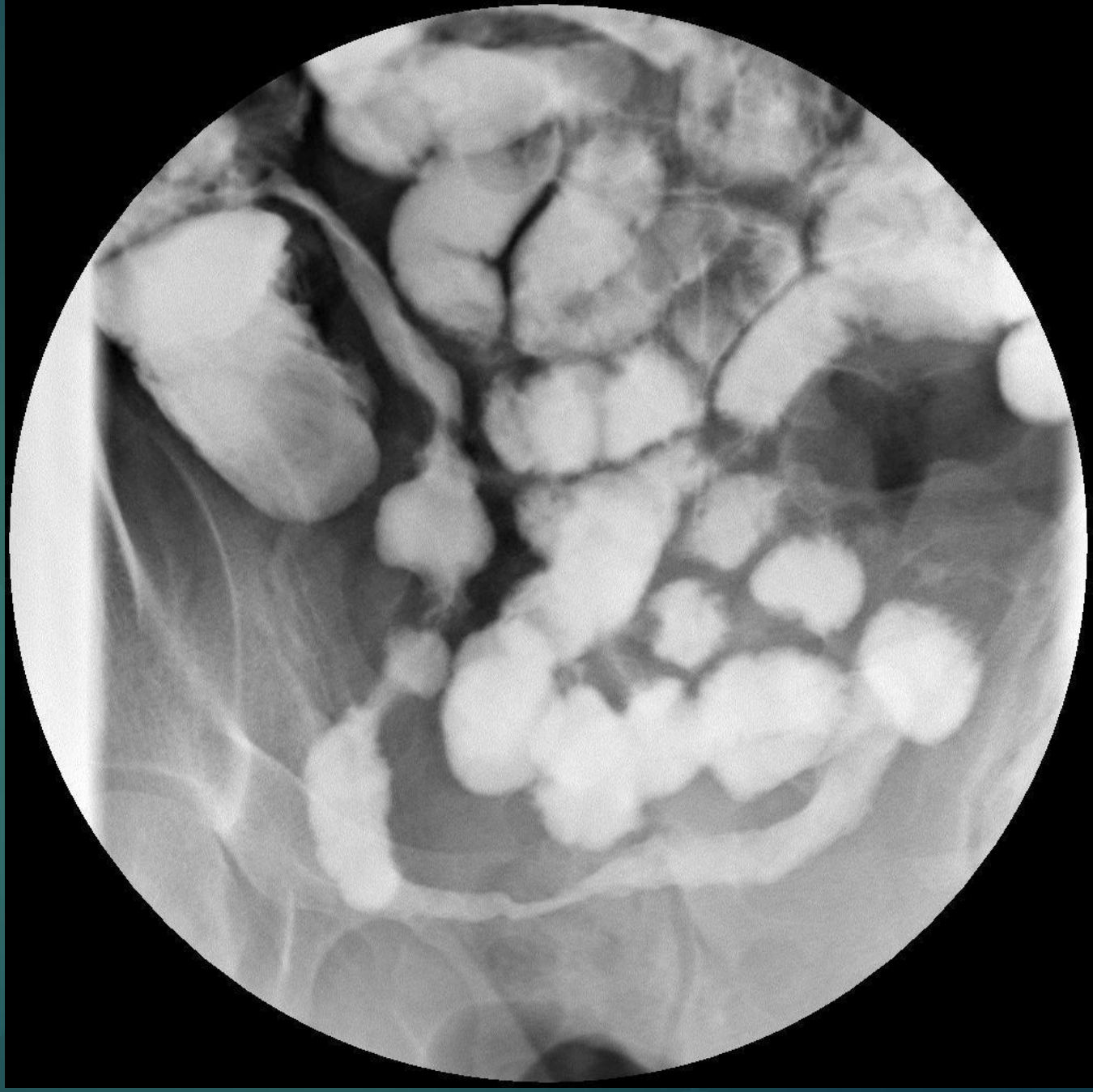
Barium study of the small bowel



String sign of Kantour (Crohn disease)

Long segment of narrowed terminal ileum in a **'string like'** configuration in keeping with a long stricture segment.

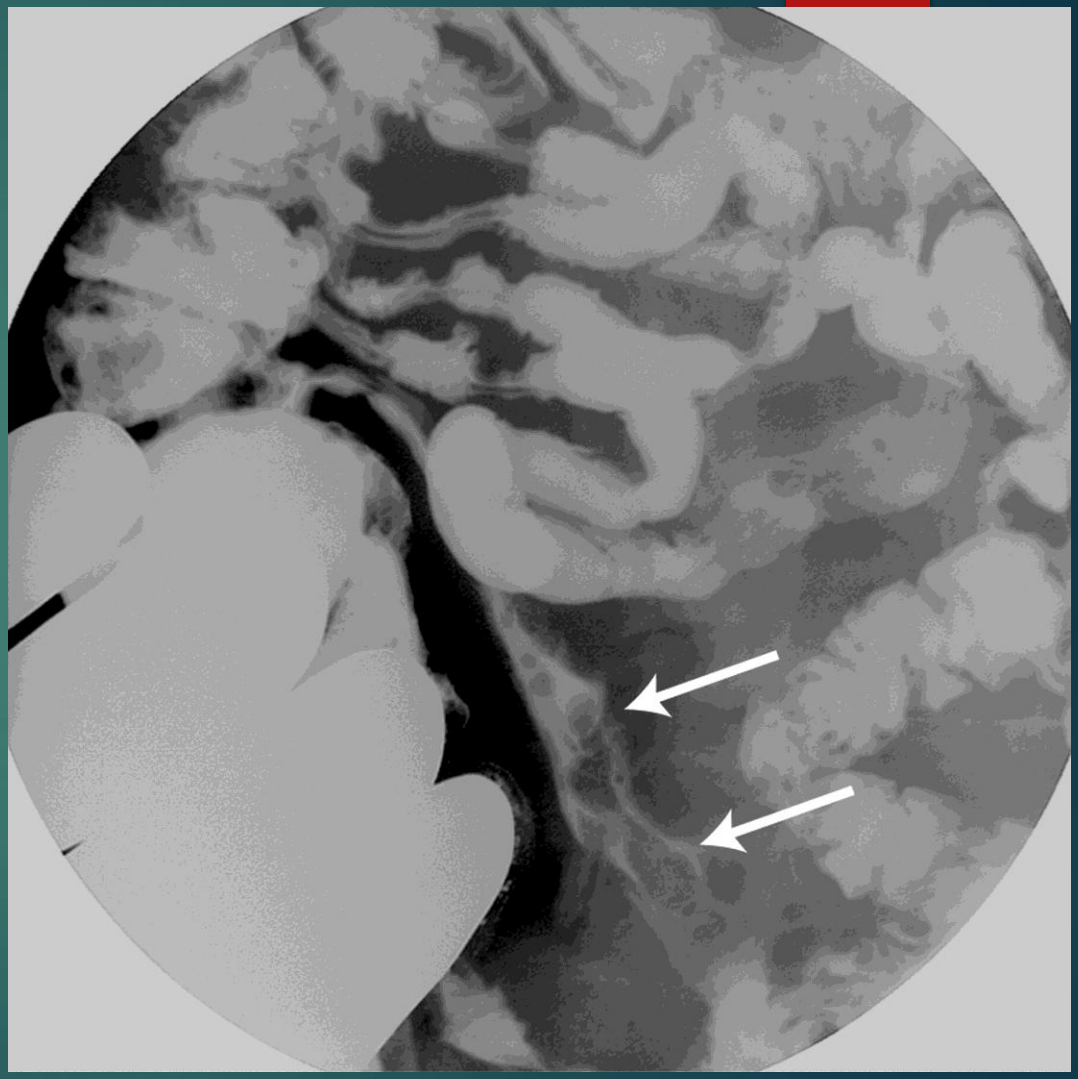
Termed the **string sign of Kantour** (**gastrointestinal string sign**).



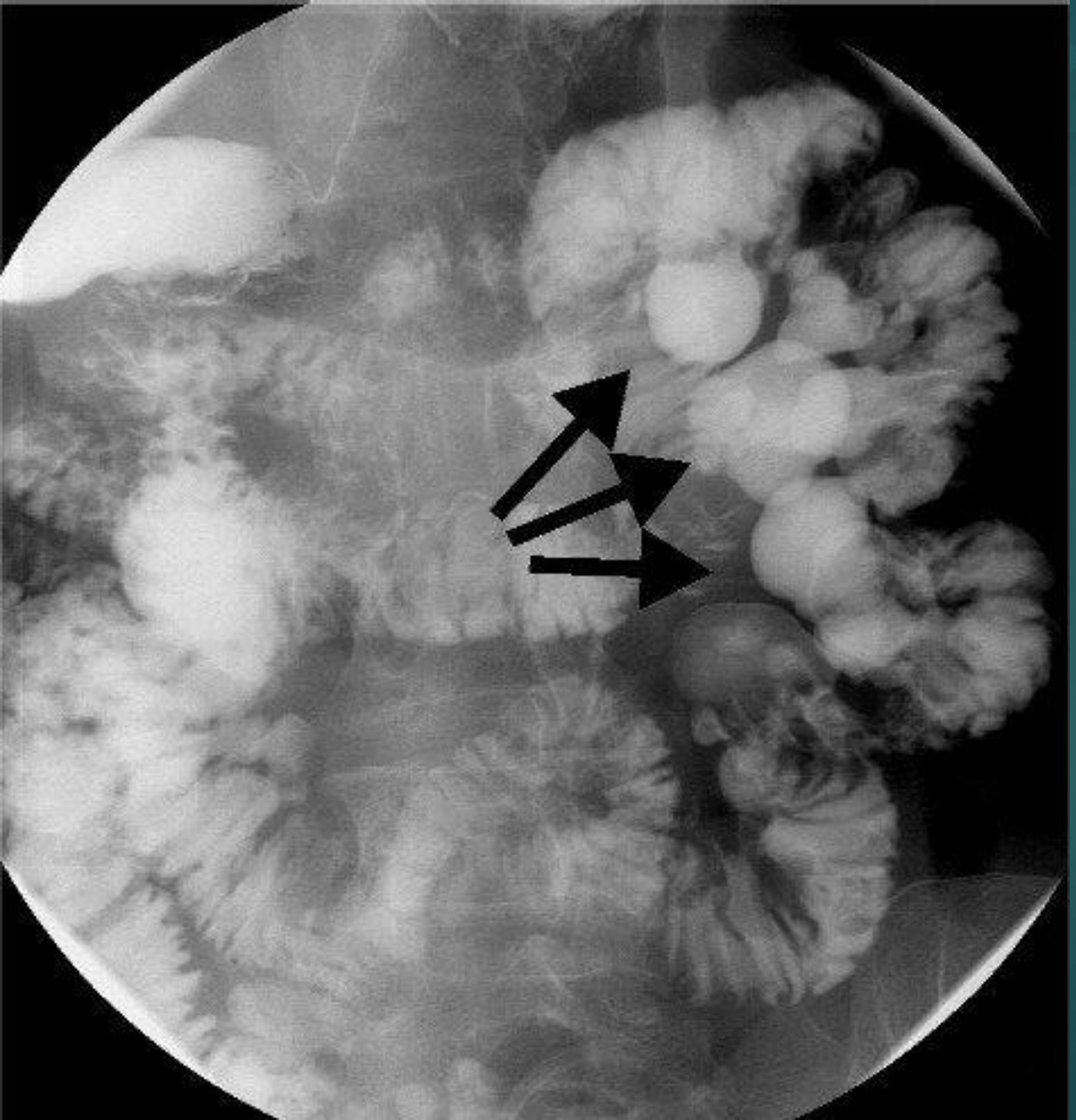
Source: https://radiopaedia.org/cases/string-sign-of-kantour-crohn-disease?lang=us

Barium study of the small bowel

Meckel's diverticulum



Early Crohn's disease



Jejunal diverticulosis

Source: Alex Mortimer et al. Jejunal diverticulitis: an unusual cause of an intra-abdominal abscess. *Journal of Radiology Case Reports*. 2008, 2(5):15-8

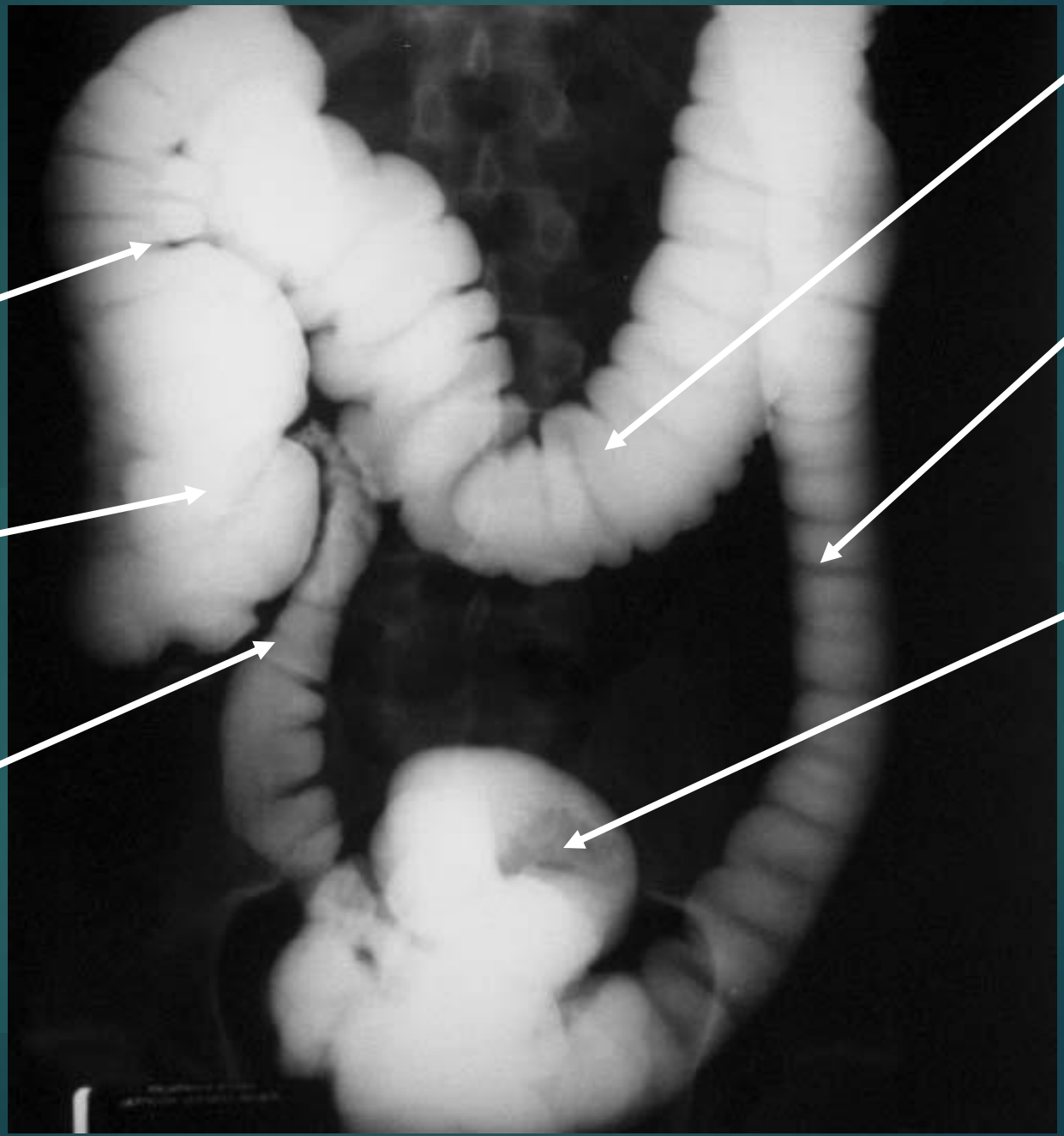
Barium enema (irrigoscopy)

All parts of the large intestine are filled with a contrast agent consistently and evenly. Their location and diameter are usual. Haustration and contours are uniform, well defined.

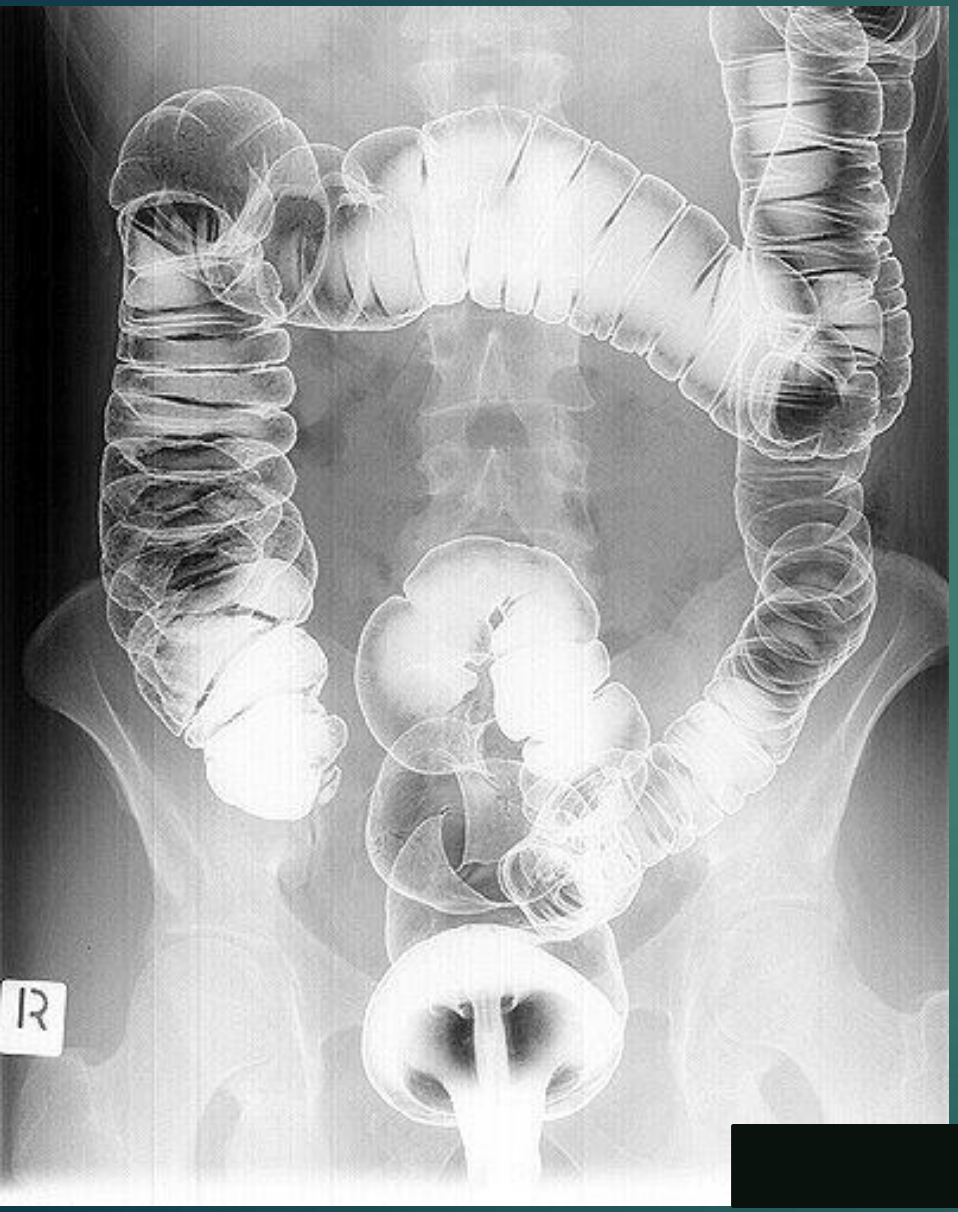
If your discover any modification, fix it (ex. In the level of sigmoid colon is detected a minus-filling defect of contour with irregular borders, for a short distance, with asymmetric narrowing of the lumen, corresponding to "apple core" sign)

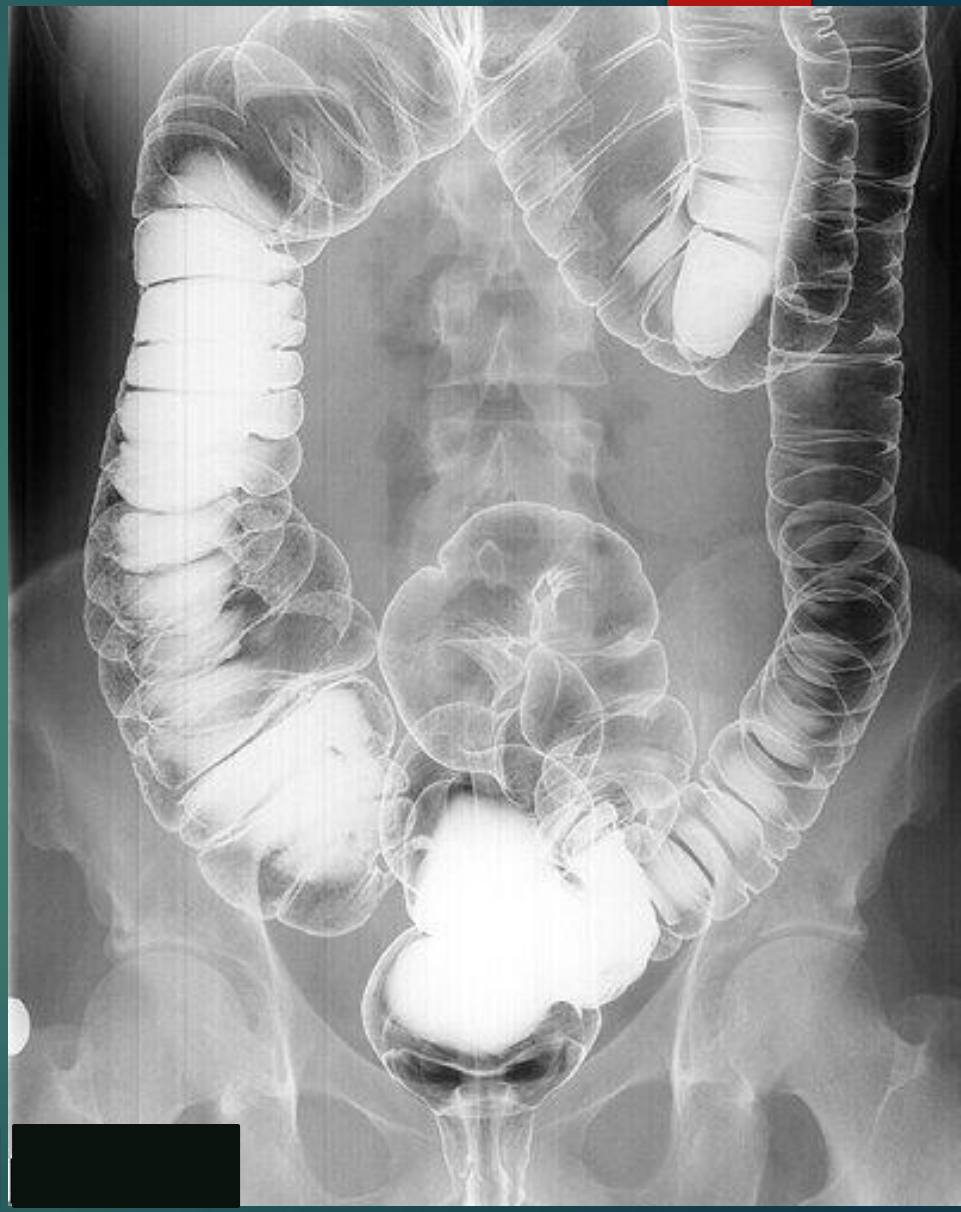
Source: https://www.medbroadcast.com/procedure/getprocedure/barium-enema

Barium Enema, Single Contrast



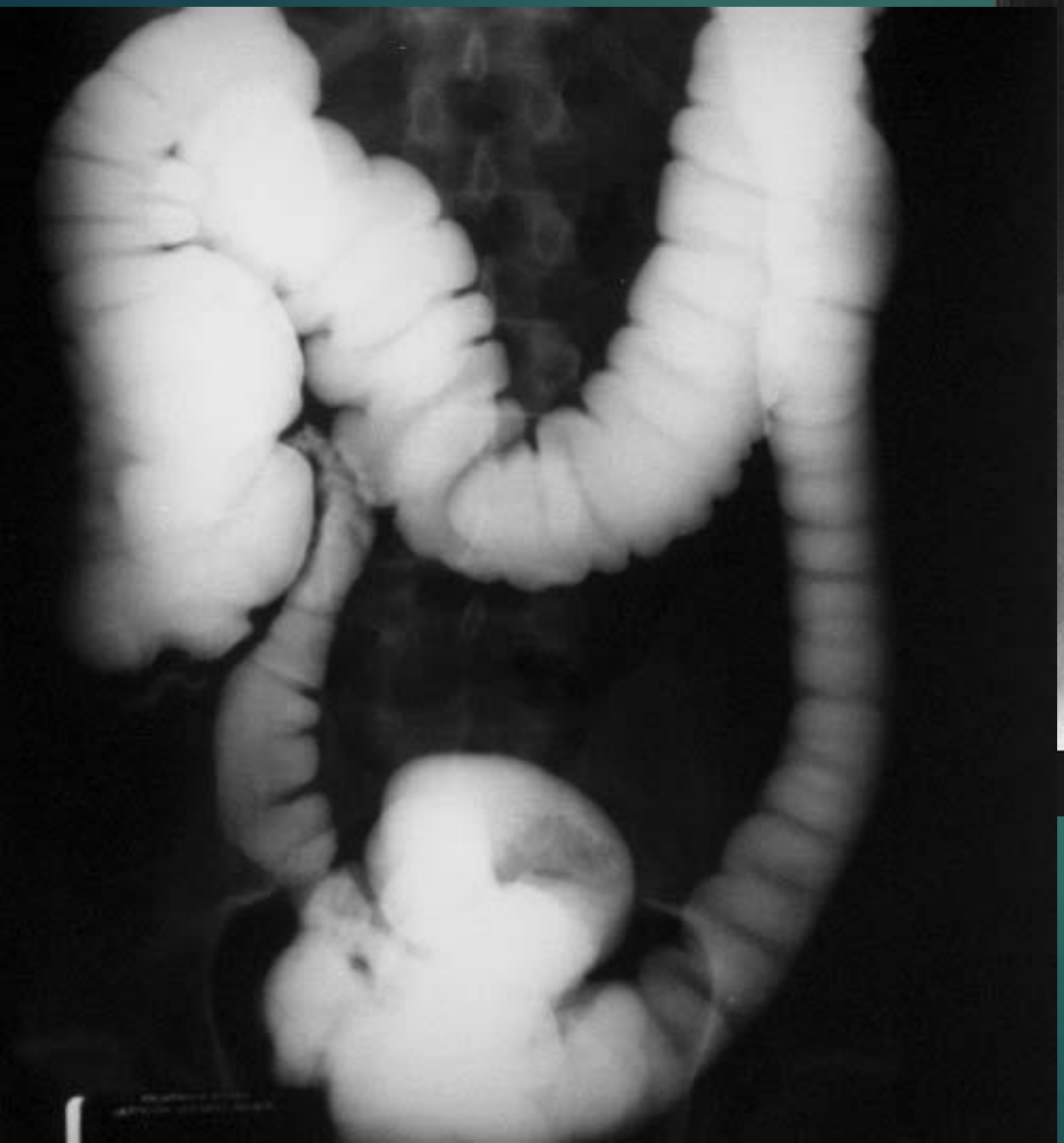
Barium Enema, Double Contrast

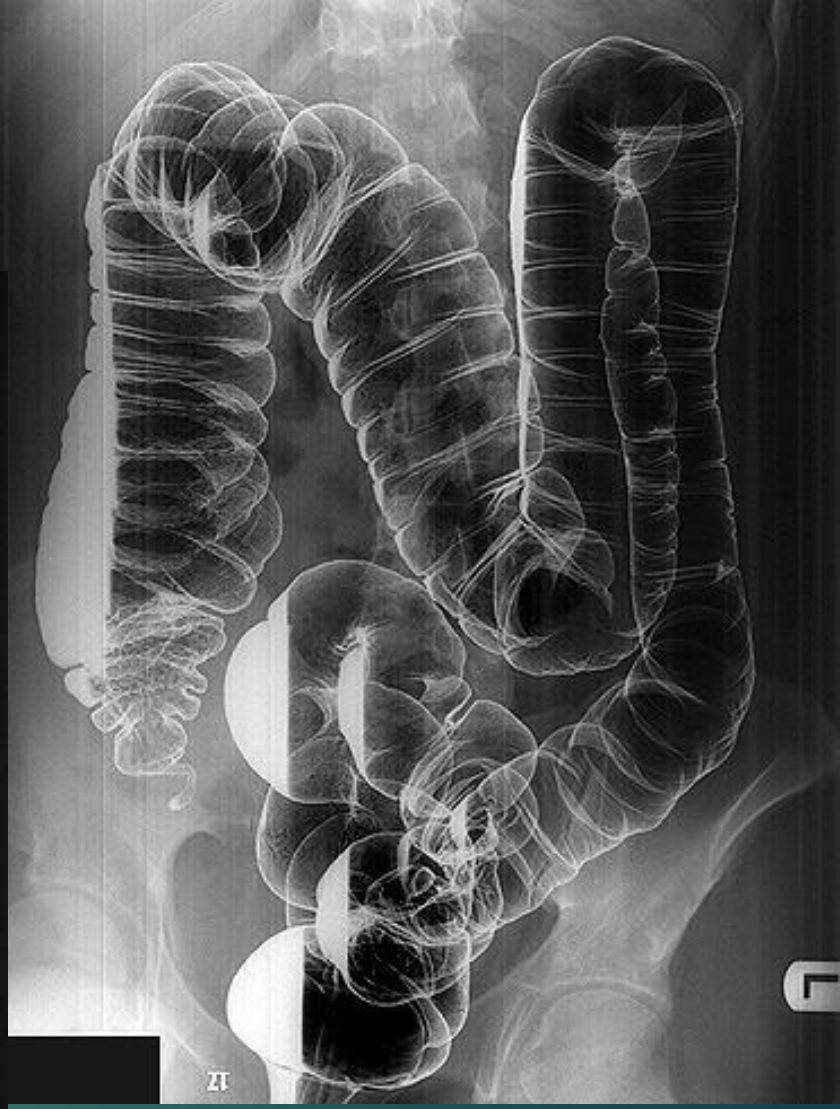




Prone position.

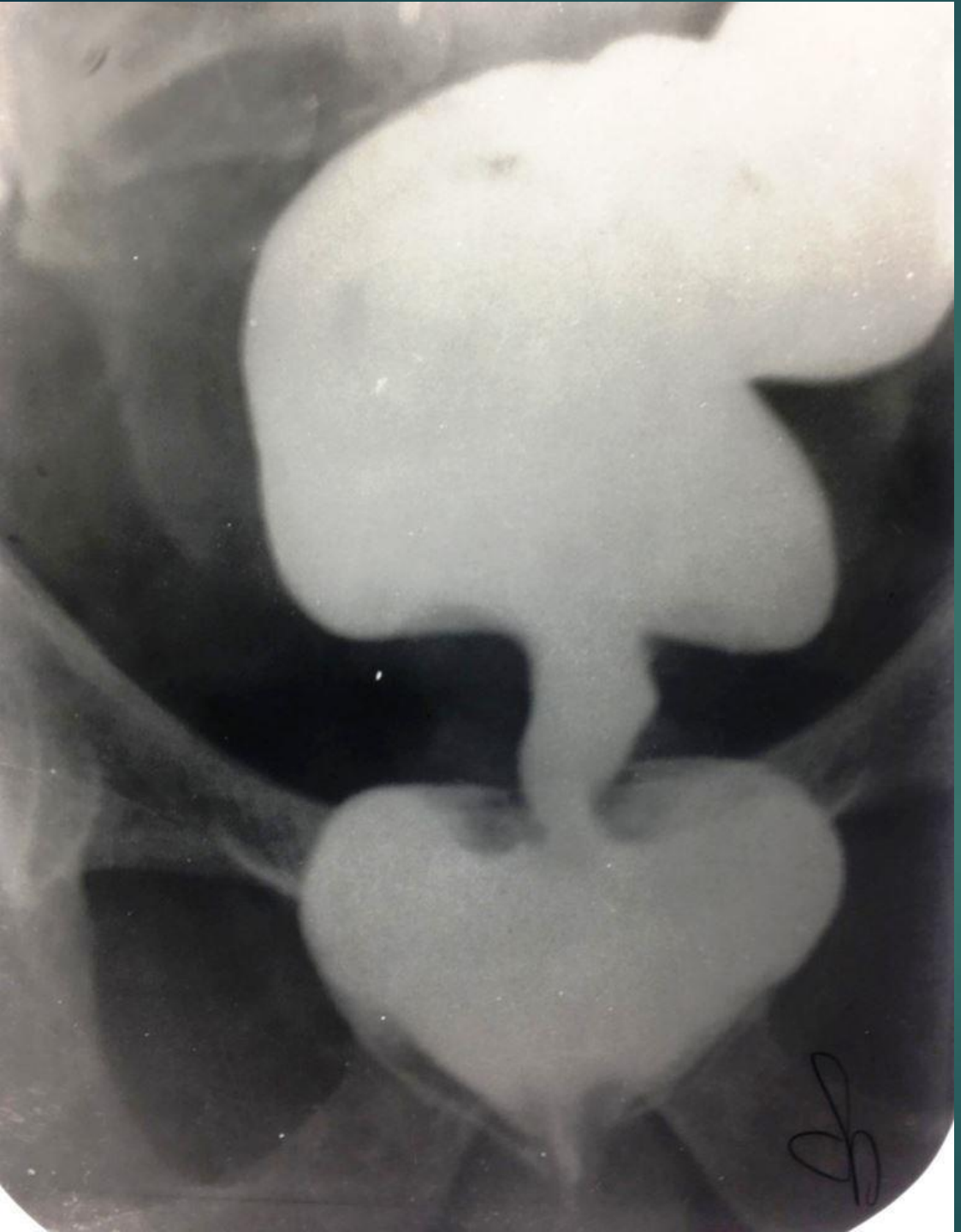
Supine position.

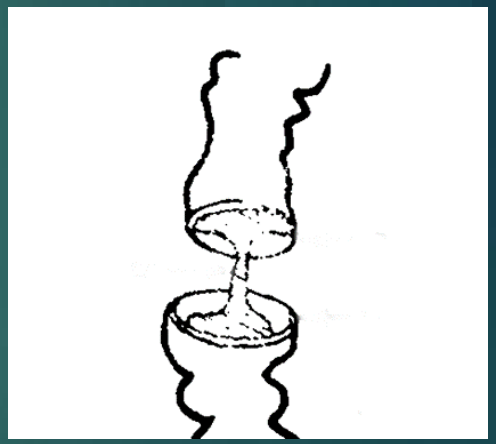




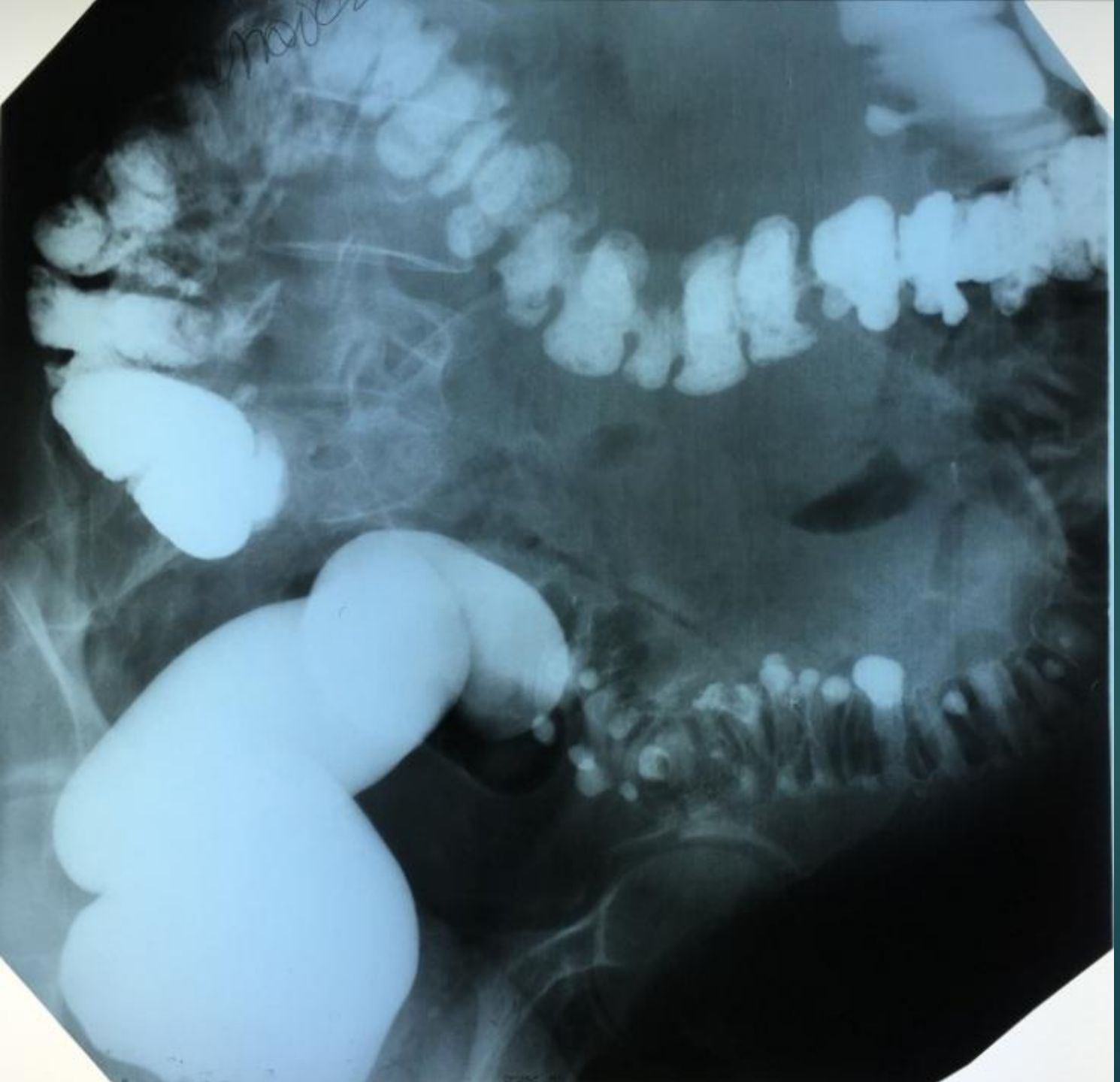
Colon Adenocarcinoma

Colon Adenocarcinoma





”Apple core” sign



Colonic diverticula

Colonic diverticula

Ulcerative colitis

The whole colon, without skips is affected by an irregular mucosa with loss of normal haustral markings.

Continuous lesion without skip, or carpeting of the whole colon is classic for ulcerative colitis.

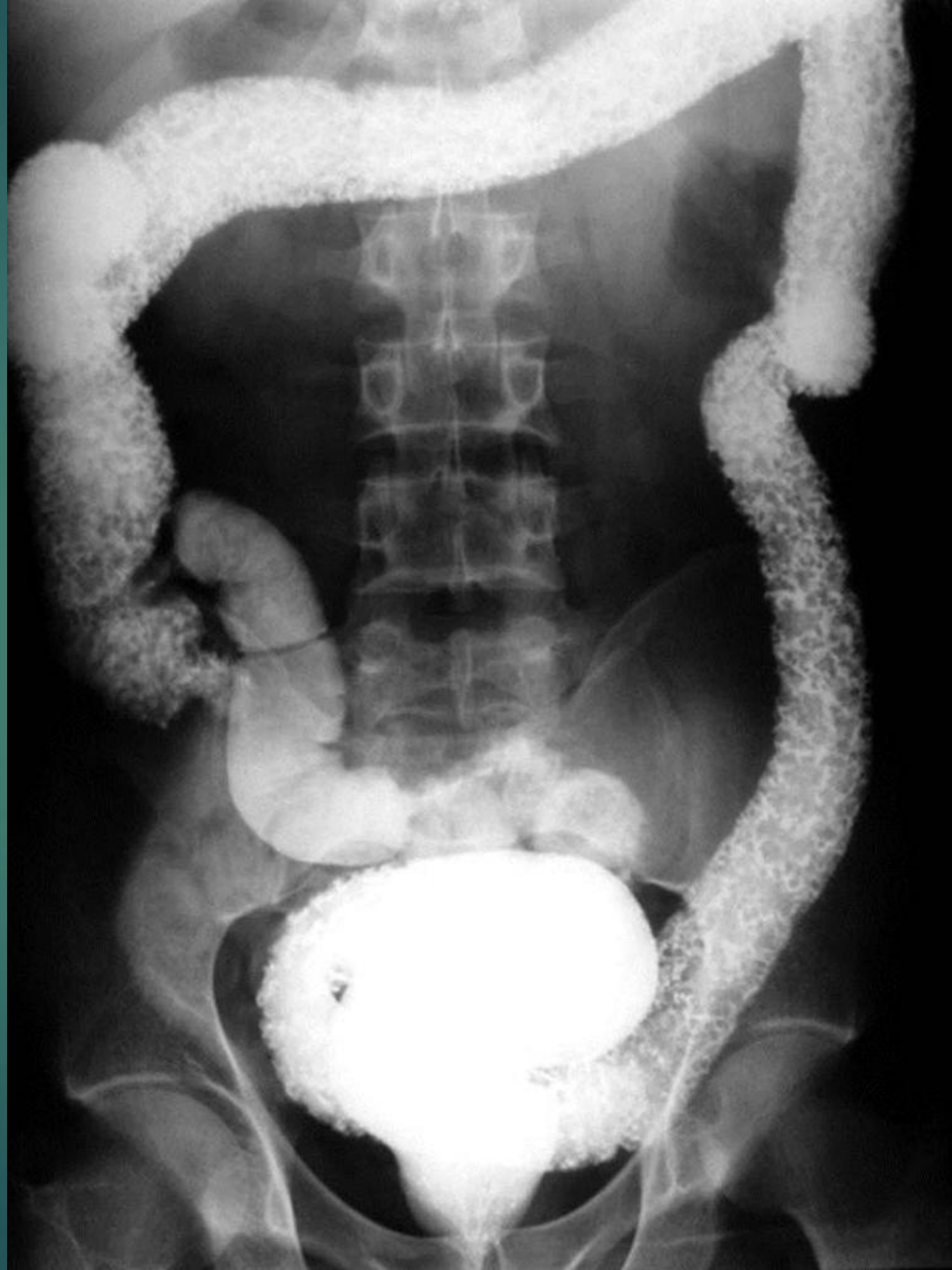
Mucosal inflammation causes a granular appearance to the surface of the bowel.

As inflammation increases, the bowel wall and haustra thicken. Mucosal ulcers are undermined (button-shaped ulcers).

When most of the mucosa has been lost, islands of mucosa remain giving it a pseudo-polyp appearance.

Ileocecal valve insufficiency is also noted.

https://radiopaedia.org/cases/ulcerative-colitis-barium-enema

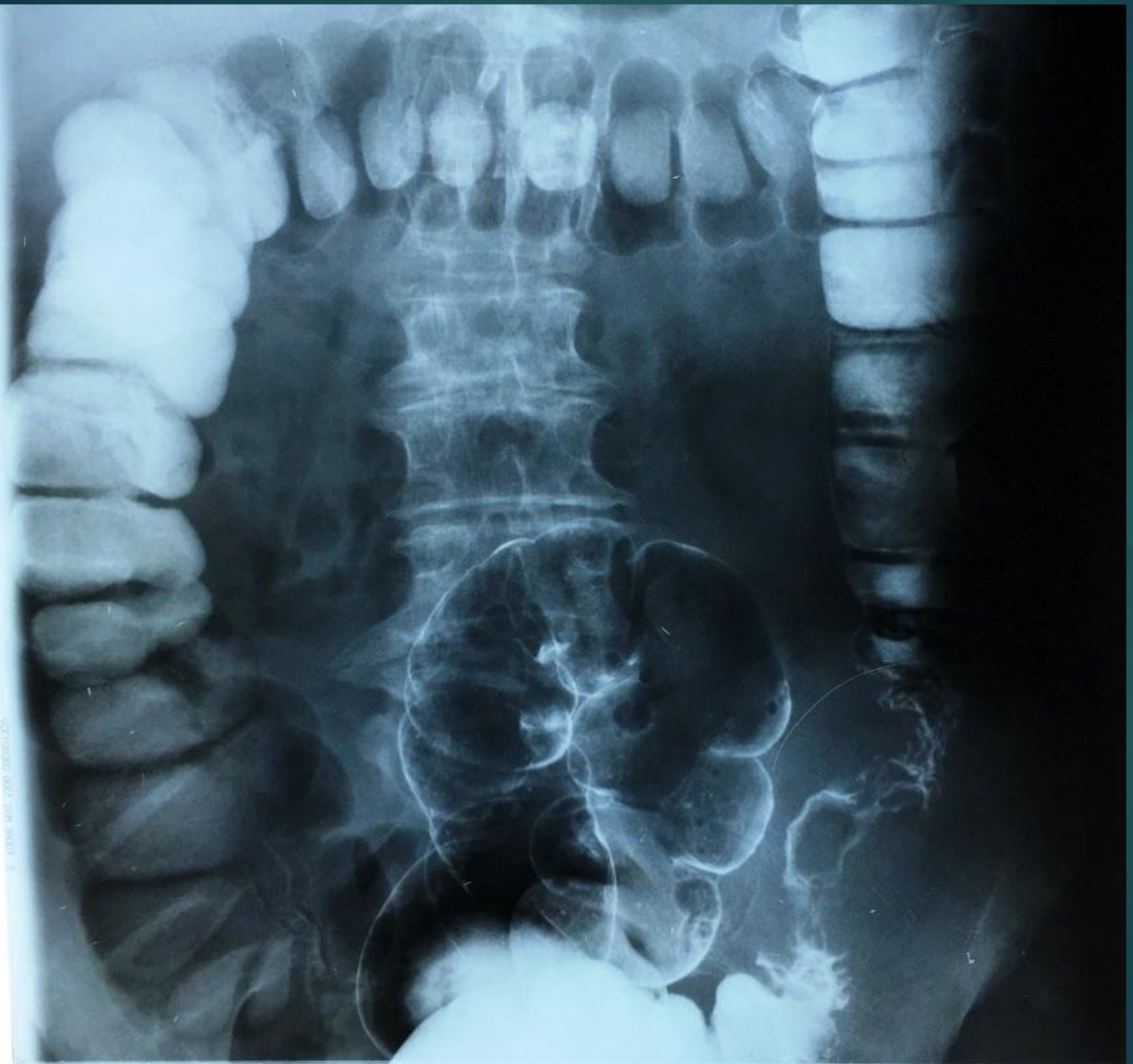


Crohn's disease

Barium enema showing Crohn's disease of the large intestine with prominent 'spiking'.

Changes of Crohn's disease include deep fissures that occur in the thickened submucosa, penetrate the bowel wall and may lead to internal fistulae or to a pericolic abscess cavity.

These fissures can often be shown radiologically **as little spikes radiating outwards from the lumen**, and this finding seems to be characteristic of Crohn's disease.



Sigmoid adenocarcinoma

Double contrast barium enema (irrigoscopy)

“Apple core” sign in the region of sigmoid colon.

Dolichosigma.