

Gastrointestinal Tract Radiological Anatomy & Investigation

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Radiological anatomy of GIT

- Esophagus
- Stomach: fundus, body, antrum, LCS, GCS
- Duodenum: 1st to 4th portion
- Small intestine: jejunum a LUQ, ileum at RLQ
- Colon: cecum, appendix, AC, TC, DC, SC, rectum

Gastrointestinal Tract

1. Plain radiograph of abdomen (KUB)
2. **Barium study**
3. Ultrasound (US)
4. **Computed tomography (CT)**
5. Magnetic resonance imaging (MRI)
6. Angiography

UGI and LGI

- UGI: esophagus, stomach, duodenum
- LGI: jejunum, ileum, colon

Abdominal X-Rays



How To Assess The Film

- **Basic Details** [name], [age] [sex]. [date] and appears well/poorly penetrated”
- Establish the **projection** of the film (AP) and whether it is **supine** or **erect**.
- check left and right
- Check Bone, Soft tissue/Solid Organs, Calcification, Gas pattern & Artefacts

How To Assess The Film: Gas

- Essentially you're looking at the bowel here.
- Before you start, **check** that there is **gas under the diaphragm (if it is visible)**
- Look at small bowel and large bowel
- **SMALL BOWEL:**
 - Because of peristalsis the outline of the gas in the normal small bowel is often **broken up into many small pockets**
 - It is generally **central in the abdomen**
 - Jejunum has '**valvulae conniventes**', ileum is characteristically **featureless**
 - The calibre of the normal small bowel should **not exceed 2.5–3 cm**
 - **If small bowel is visible at all, it suggests that it is abnormal**

How To Assess The Film: Gas

- **LARGE BOWEL:**

- The caecum therefore normally contains semifluid material containing multiple pockets of gas and, like much of the right side of the bowel, assumes a granular appearance on X-rays, creating mottled areas of gas seen best against the background of the iliac bone.
- When visible the haustral folds of the colon may be seen, only partially visualised across part of the large bowel lumen.

How To Assess The Film: Bone

- Ribs, spine, sacrum, pelvis & hips
- Bones may show evidence of malignant disease
- Sacro-iliitis may be associated with intestinal problems such as Crohn's disease
- Excessively sclerotic bones may hint at other diseases e.g. Paget's (which can present as abdominal pain) or GI ulcers (which are associated with sclerotic bone lesions)
- Don't forget to check the spine for conditions such as ank spondy

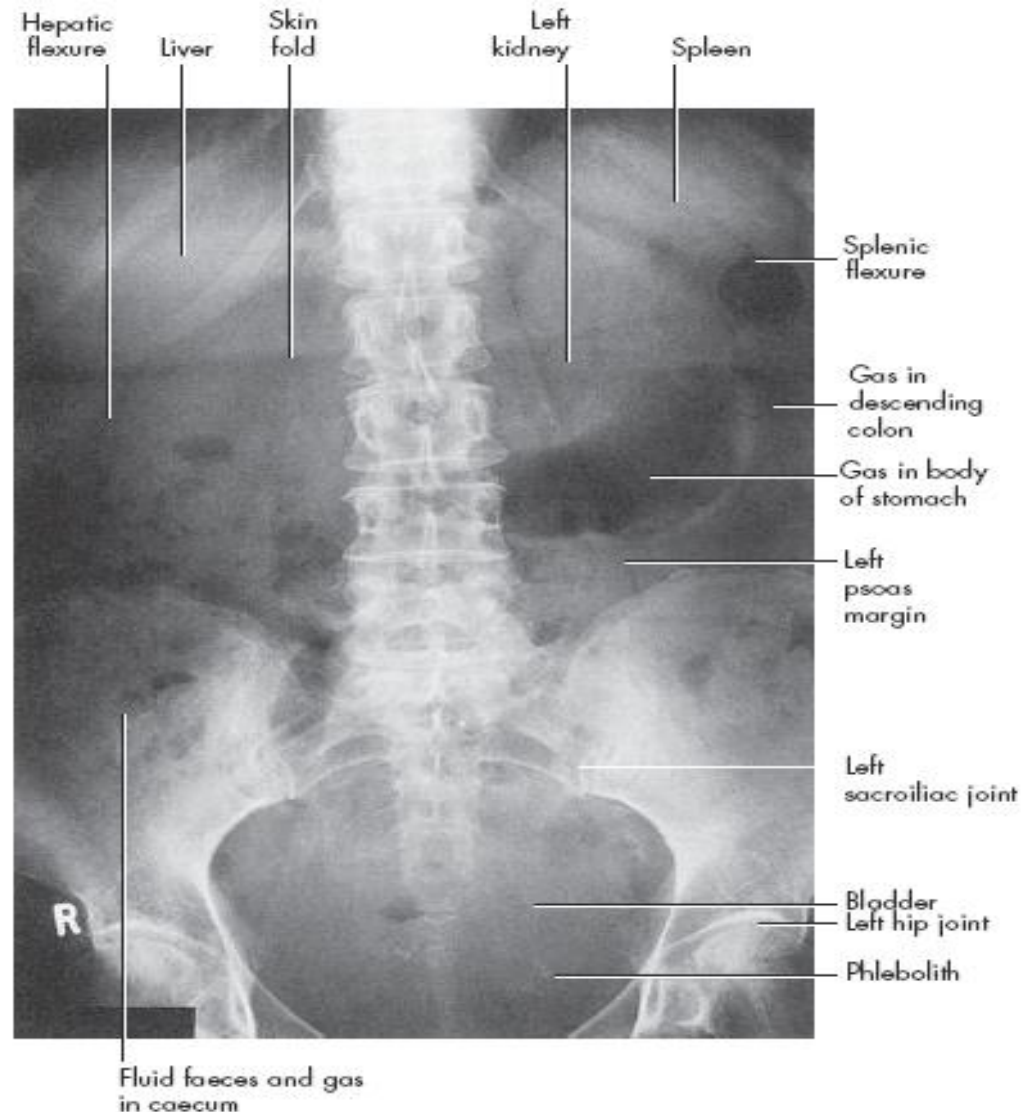
How To Assess The Film:

Soft Tissue

- Trace soft tissue outline for any clues as to pathology (e.g. obesity, trauma sites, abdo drains etc)
- Also look for:
 - Psoas muscles
 - Kidneys (left is higher and slightly bigger than the right)
 - Liver (difficult to see but may be identifiable by lack of bowel in RUQ)
 - Spleen (difficult to see)
 - Bladder (visible if full, not always visible if empty) – a full bladder may hint that you are looking for an acute problem, rather than a chronic one
 - Uterus (causes a dent in the top of the bladder on IVU)

AXR/Plain Abdominal Film

- These are usually done with the patient lying down (**supine film**).
- **Erect films** are used to show any fluid levels (**suspects either obstruction or ileus**)
- If you are given a **CXR and an AXR**, the clinician is probably interested in **air under the diaphragm** and so suspect diseases that feature perforation as a complication (e.g. **IBD & diverticular disease**)
- An AXR should include the lower anterior ribs
- Ideally, patients should have empty bladders for an AXR



AP SUPINE ABDOMEN

18 YR OLD MALE

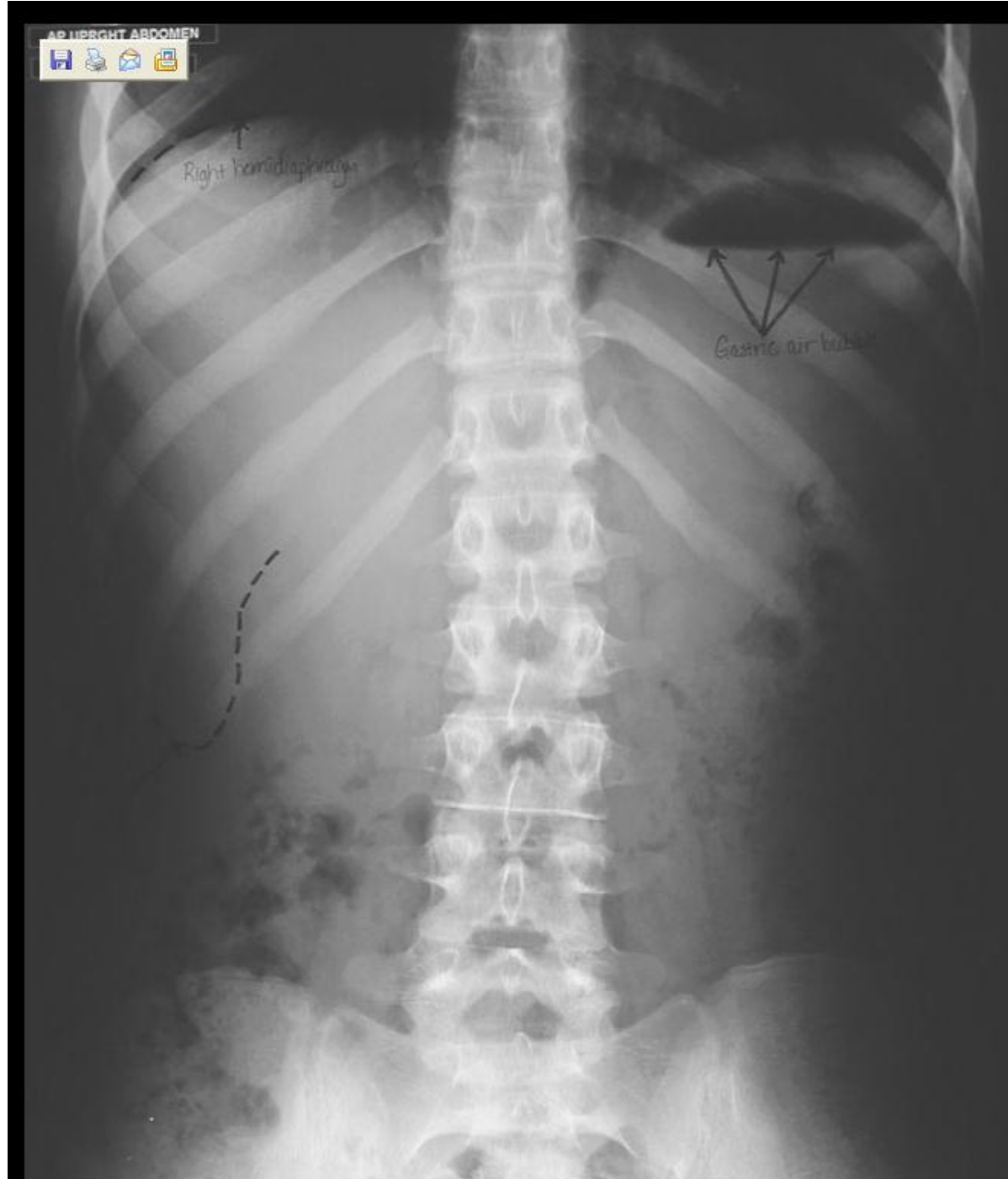


AP UPRIGHT ABDOMEN



↑
Right hemidiaphragm

↖ ↗ ↘
Gastric air bubble













- Right transverse process of L3
- Psoas major muscle
- Ala of sacrum
- Left sacroiliac joint
- Coccyx
- Ischial spine
- Left 12th rib
- Iliac crest

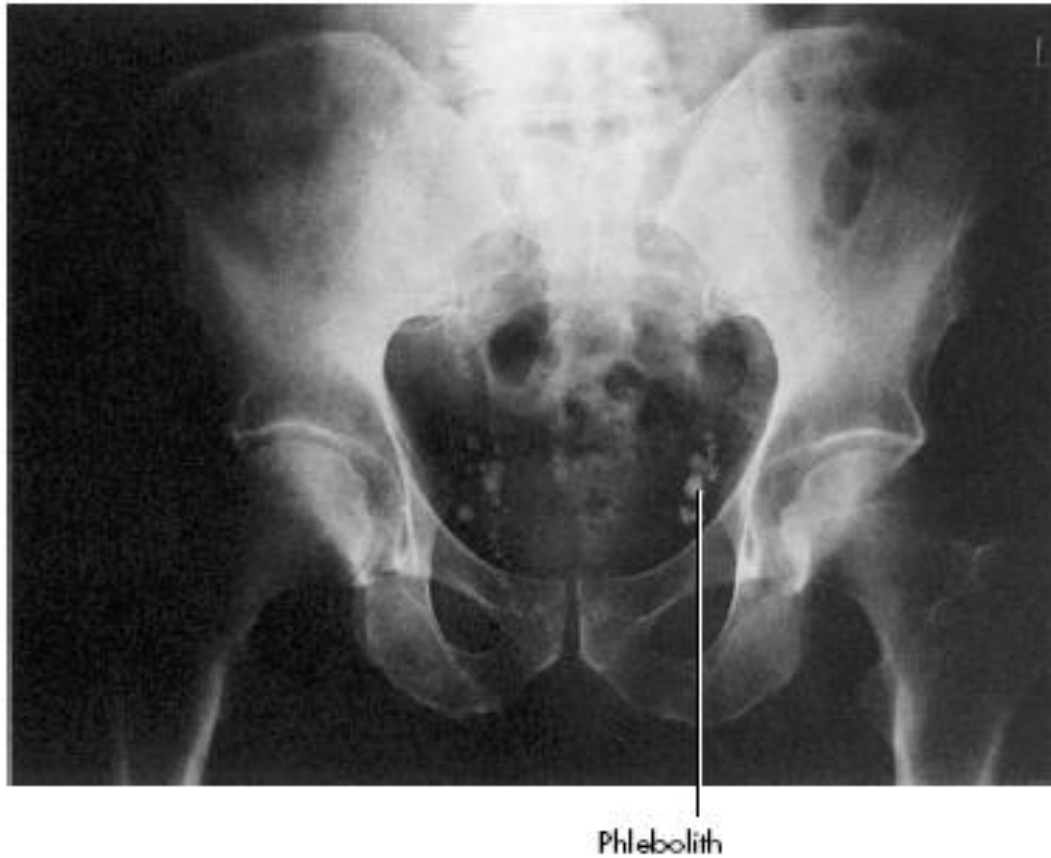


- A Lateral margin of the psoas muscle
- B Inferior pole of the left kidney
- C Left L5-S1 facet joint
- D Left sacroiliac joint

How To Assess The Film: Calcification

- Calcification occurs in:
 - **Calculi** (look in kidney, ureters & bladder)
 - **Phleboliths** (usually within pelvis, look like silt)
 - **Appendicoliths** (caused by faeces in appendix, may suggest appendicitis)
 - **Lymph nodes**
 - **Aortic calcification** (aortic calcification is normal as age increases but you must check the aorta as asymmetry of the walls suggests aortic aneurysm)

How To Assess The Film: Calcification



How To Assess The Film: Calcification



Calcified lymph nodes

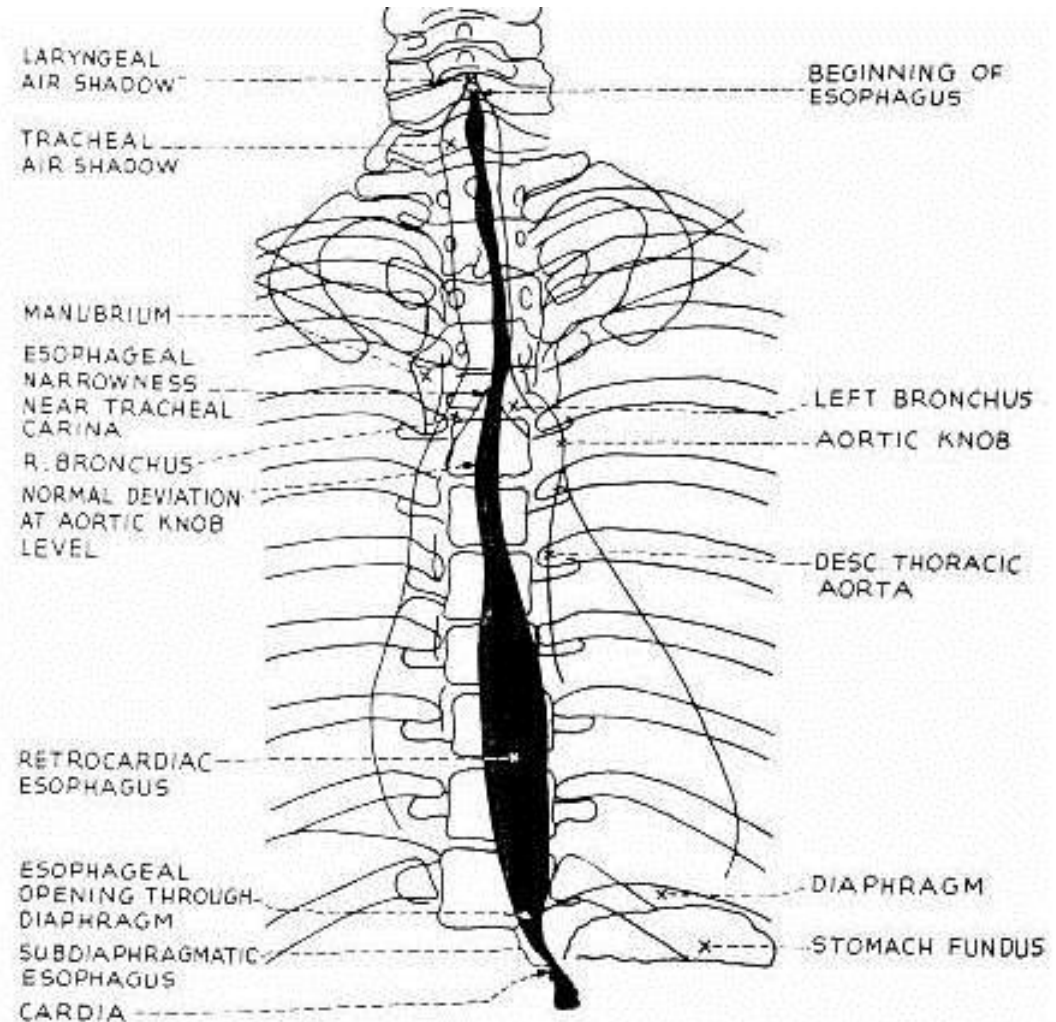
How To Assess The Film: Calcification



Calcification of a normal aorta

Barium Swallow

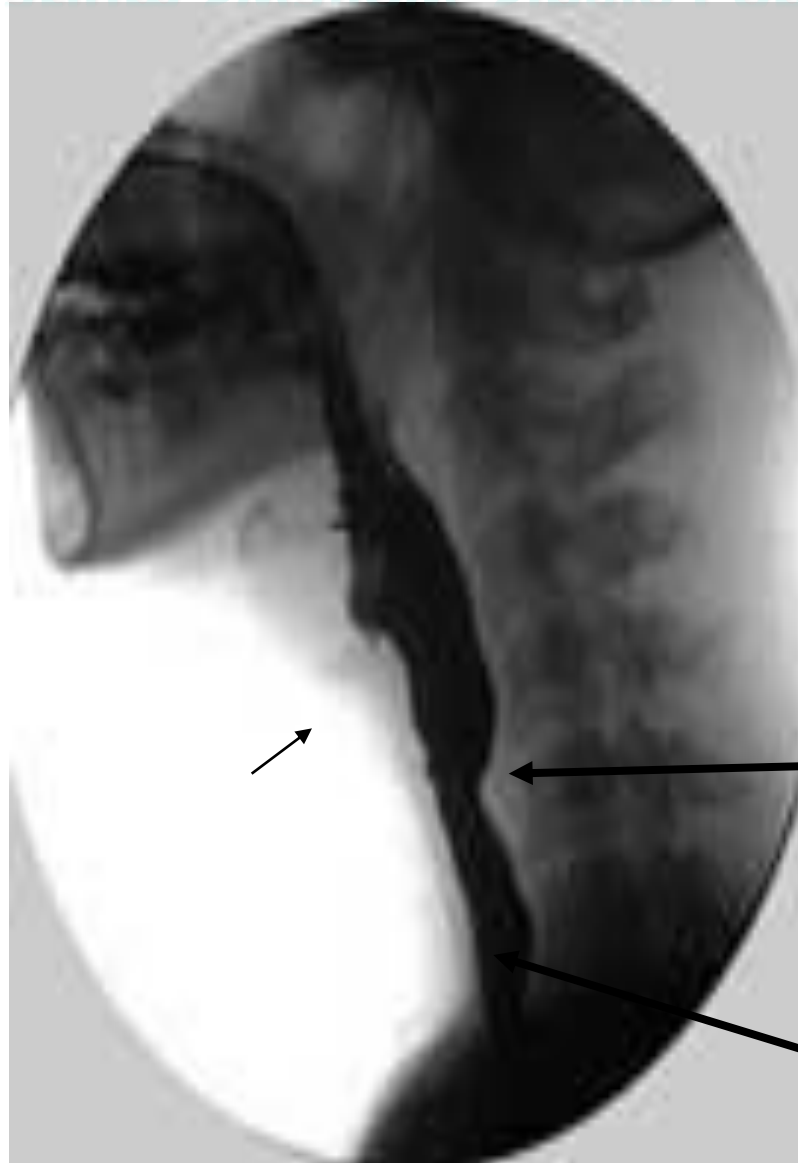
- Single contrast study, used mainly to look at the oesophagus
- Liquid barium is swallowed in an upright and prone position and radiographs are taken during the oesophageal phase of transit





Upper gastrointestinal tract radiography, also called an upper GI, is an x-ray examination of the pharynx, esophagus, stomach and first part of the small intestine (also known as the duodenum) that uses a special form of x-ray called fluoroscopy and a contrast material called barium.

Barium Swallow, Single Contrast



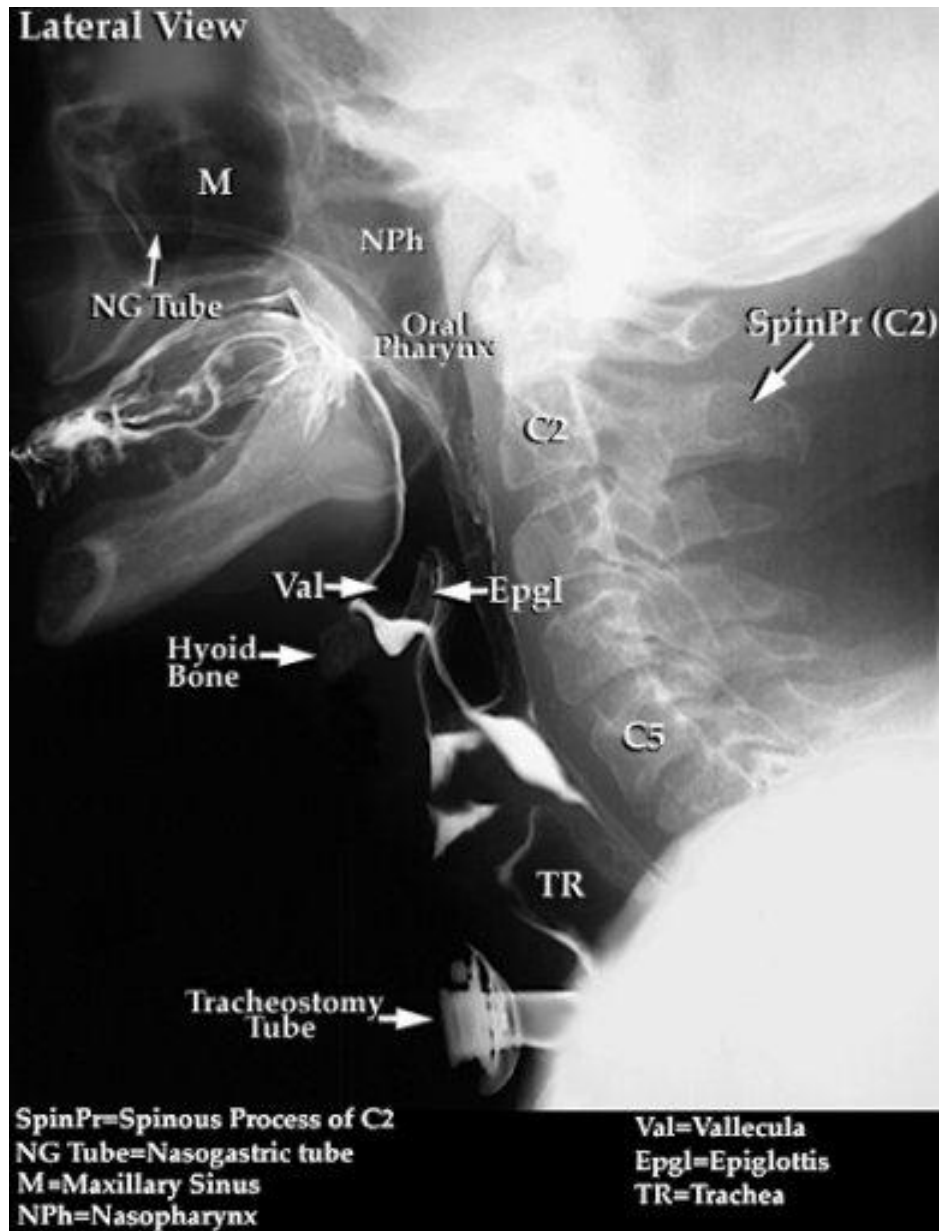
**Cricopharyngeus
Muscle**

At level of **C5-C6**,
Part of upper esophageal
sphincter (UES)

Esophagus

Barium Swallow, Single Contrast

Main Indication:
Dyshagia



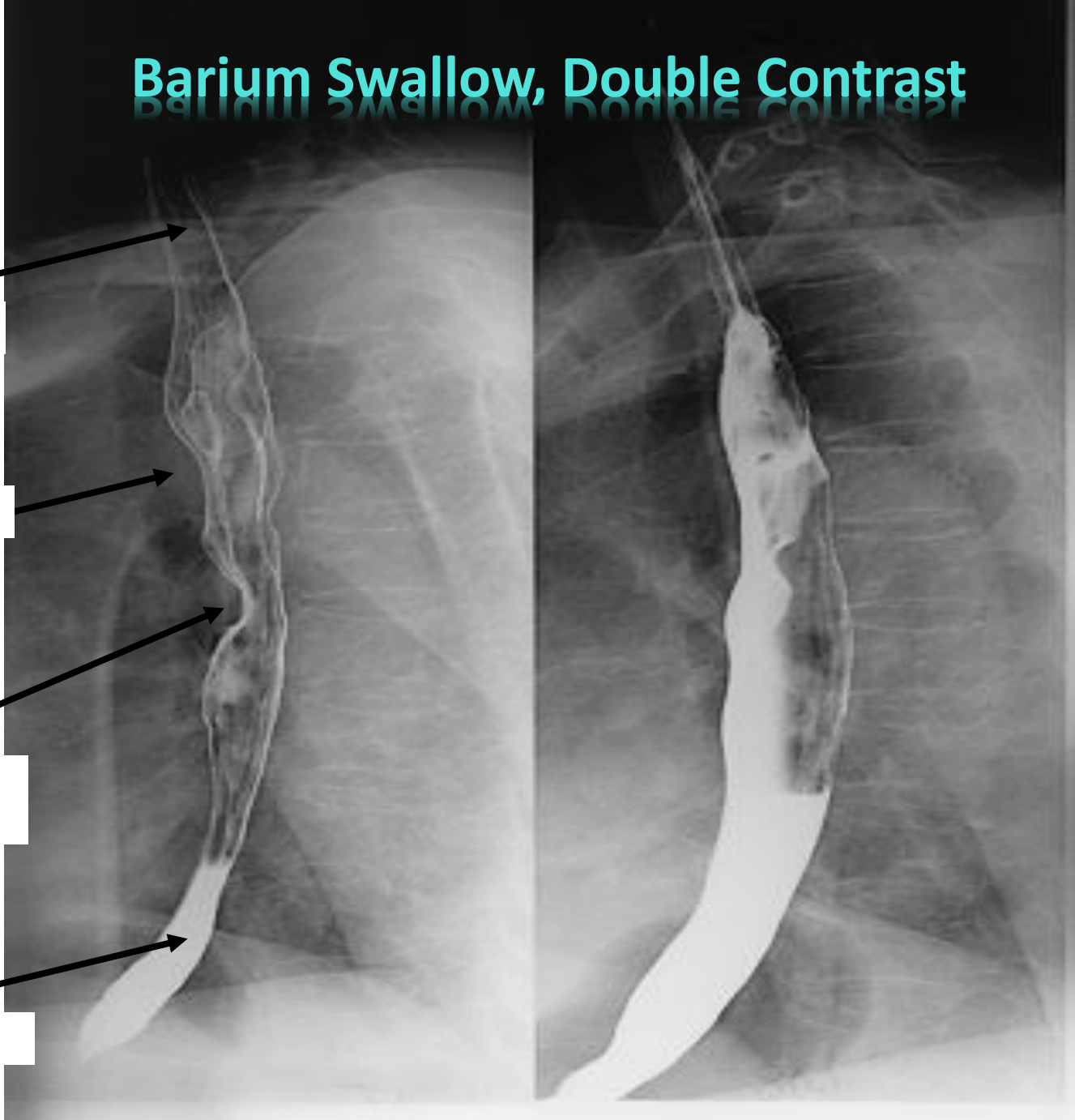
Barium Swallow, Double Contrast

Double Contrast

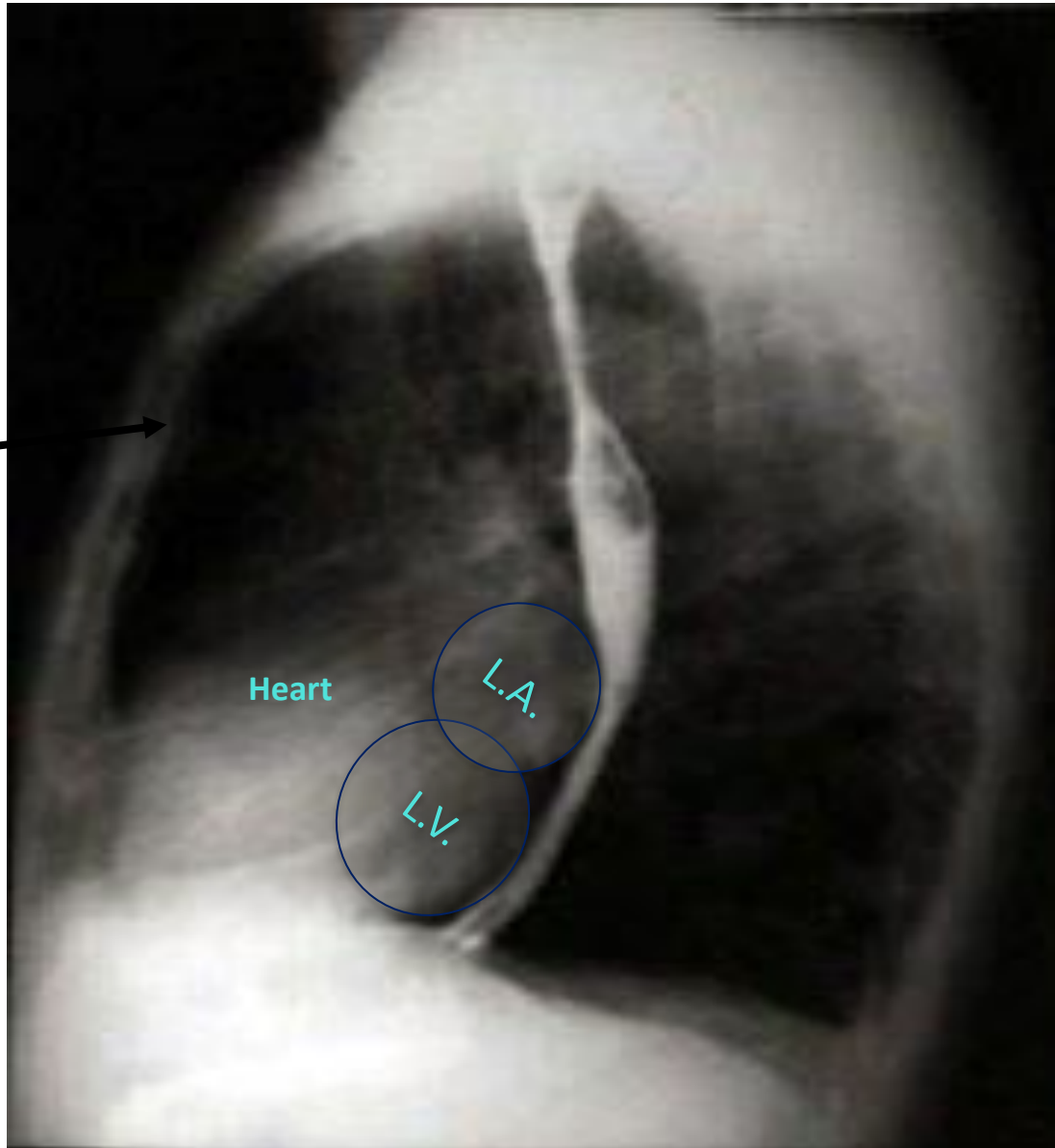
Indentation of A.A

Indentation of
L.main bronchus

Single Contrast



Barium Swallow, Single Contrast



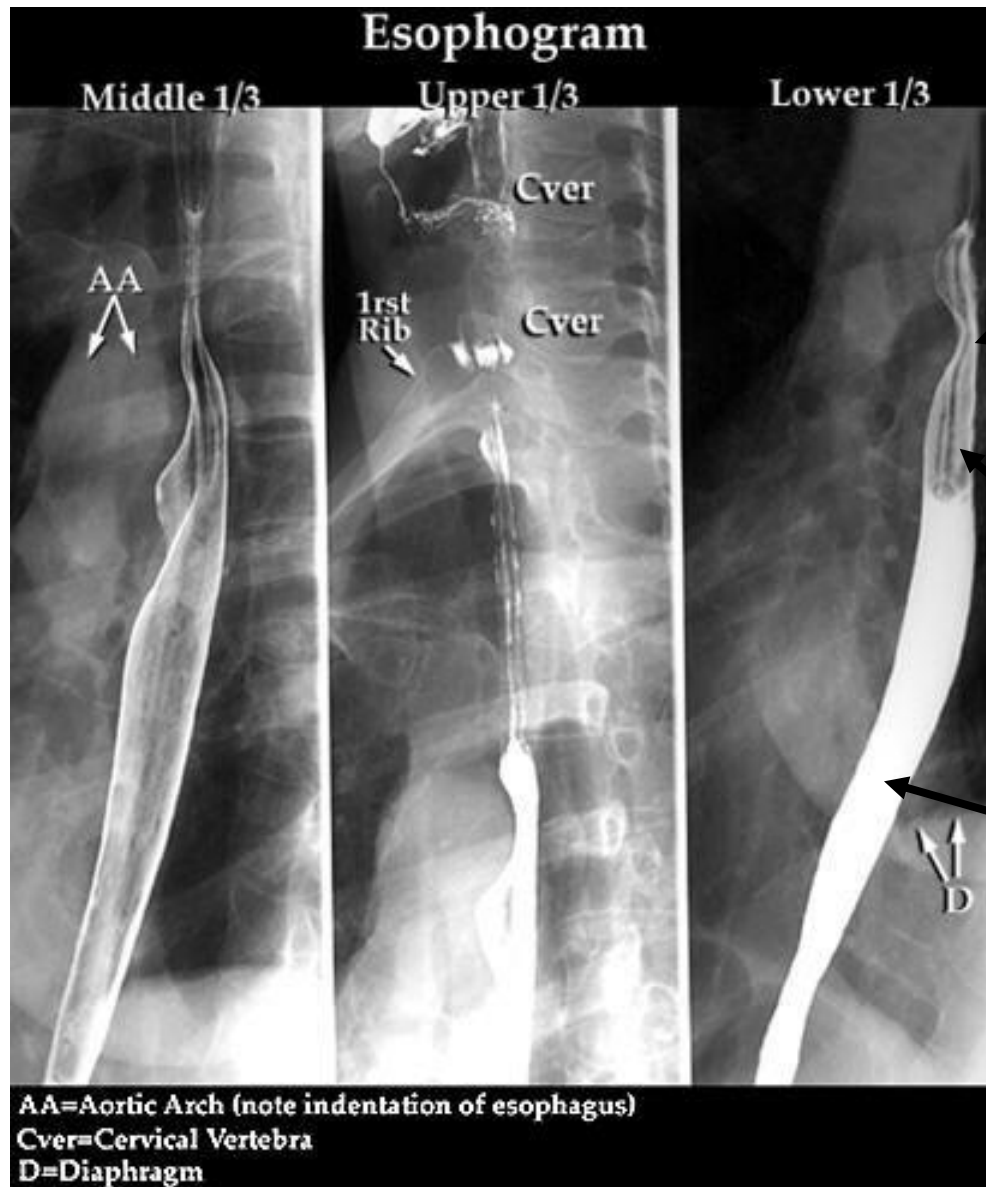
Double Contrast

Heart

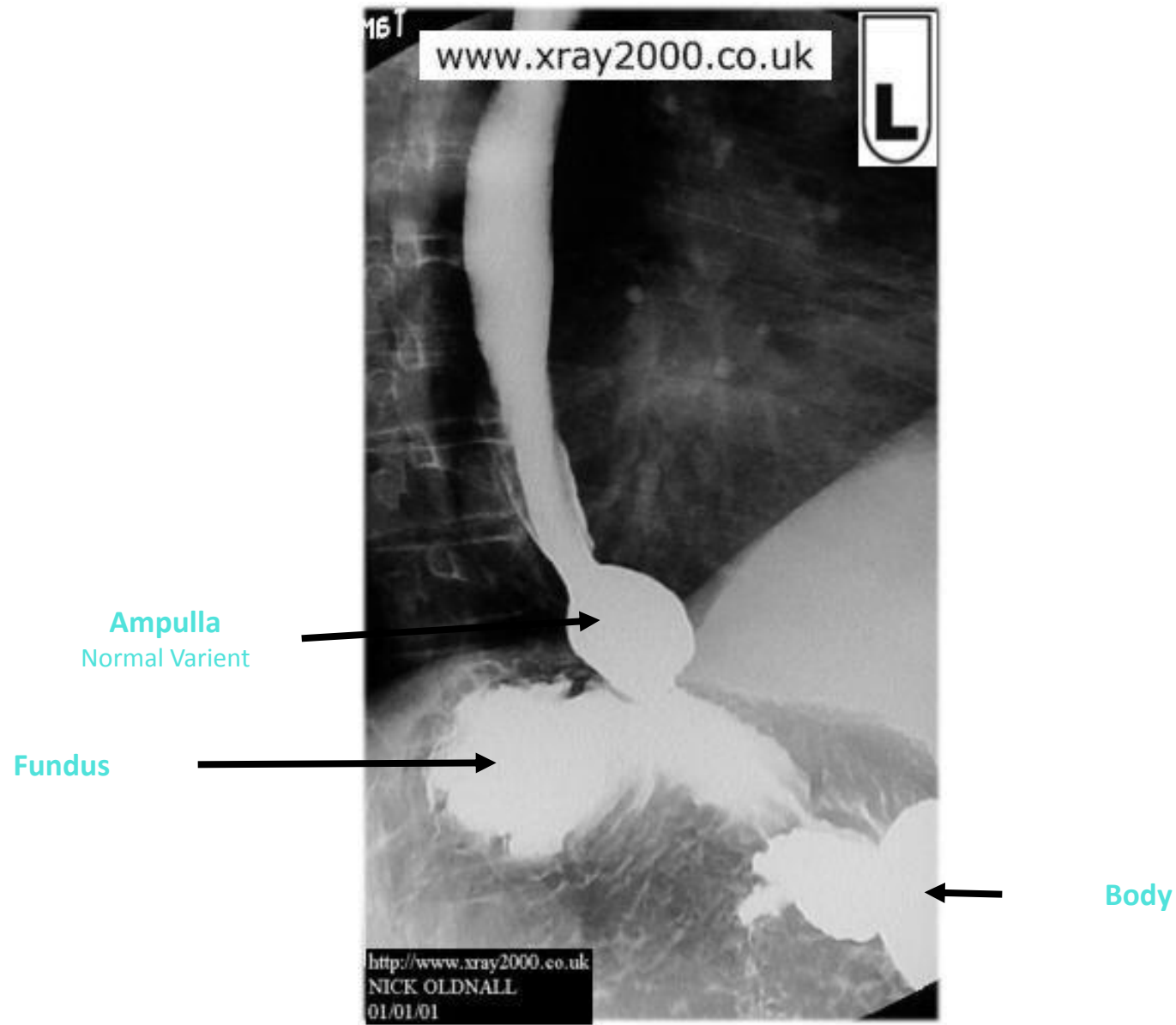
L.A.

L.V.

Barium Swallow, Double Contrast



Barium Swallow, Single Contrast



Barium Swallow, Single Contrast



Aortic Arch

Barium Swallow, Double Contrast

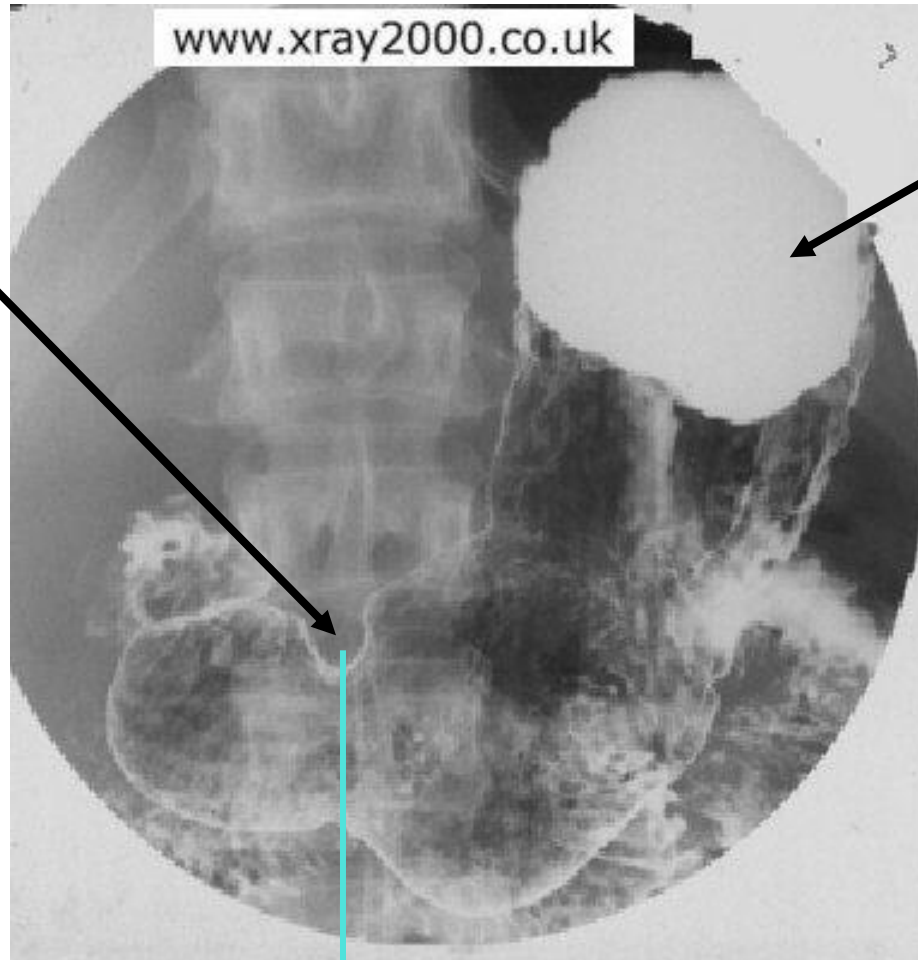
Narrowing:
Could be peristalsis
So other shot is advised



Barium Meal, Double Contrast (Supine Position)

Supine Position:
Note Barium Distribution in
the Fundus due to gravity

Angular Notch
Incisura Angularis

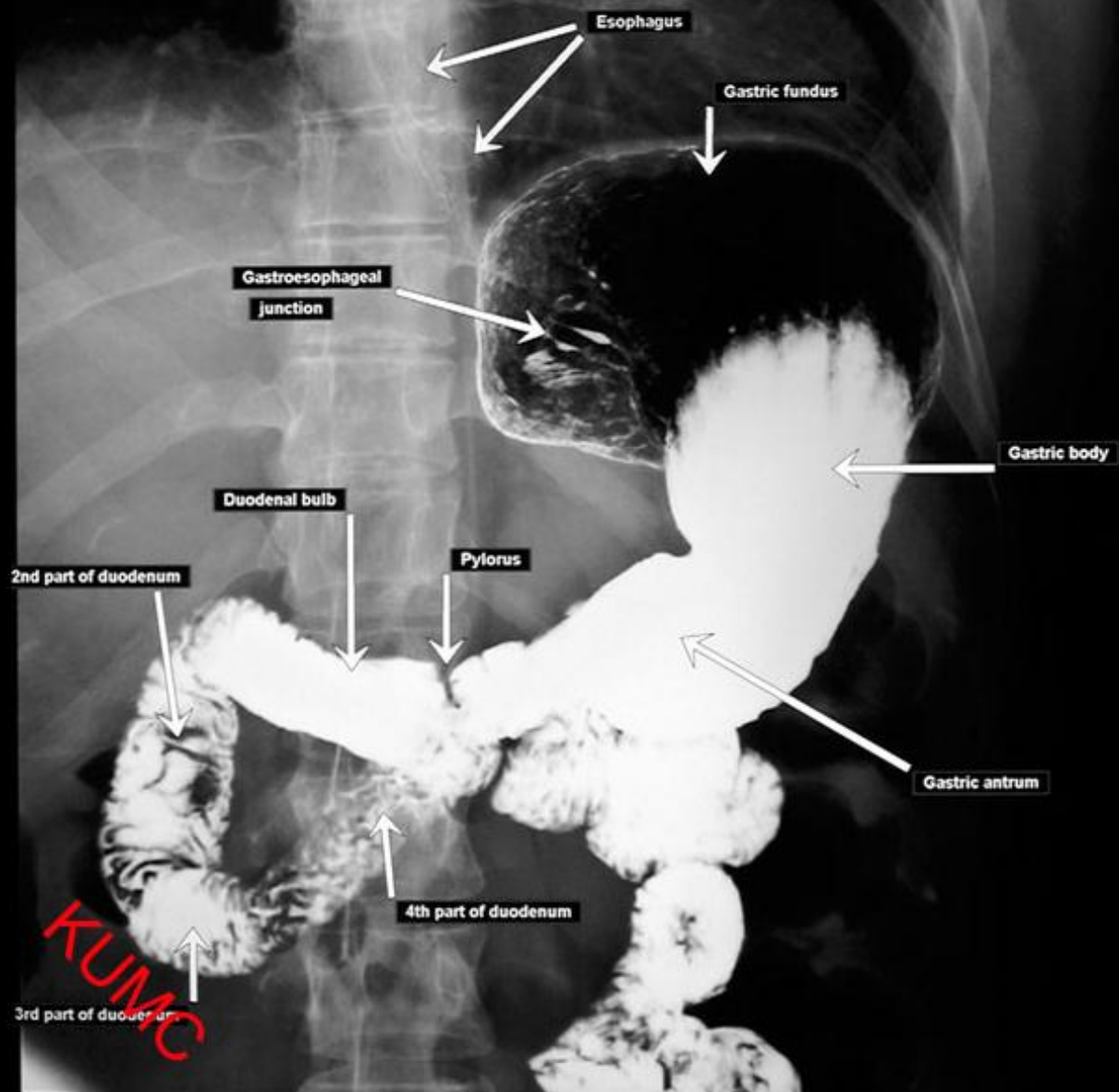


← Antrum → ← Body →



BY

39 YR OLD FEMALE



↑
barium on patient's gown

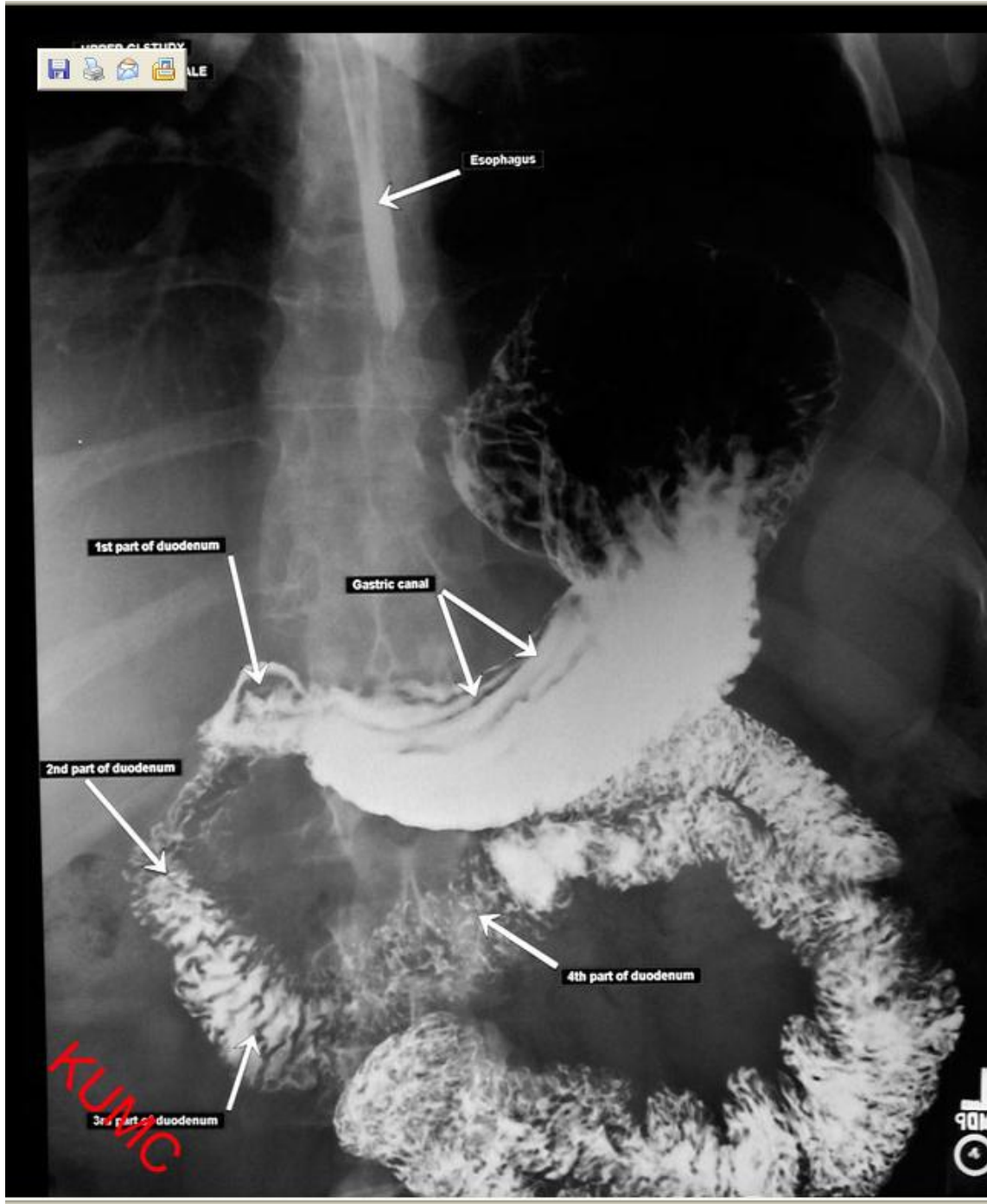
Lesser curvature

Pyloric orifice

Greater curvature

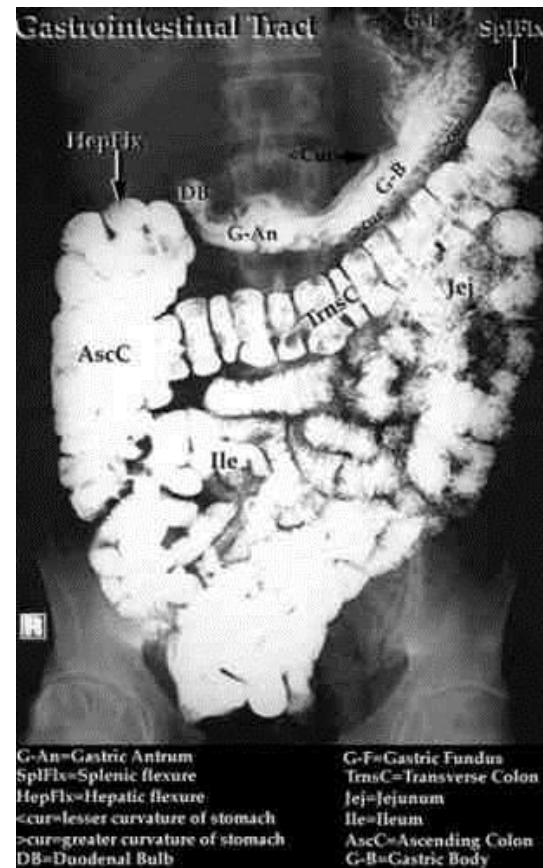
Gastric rugae

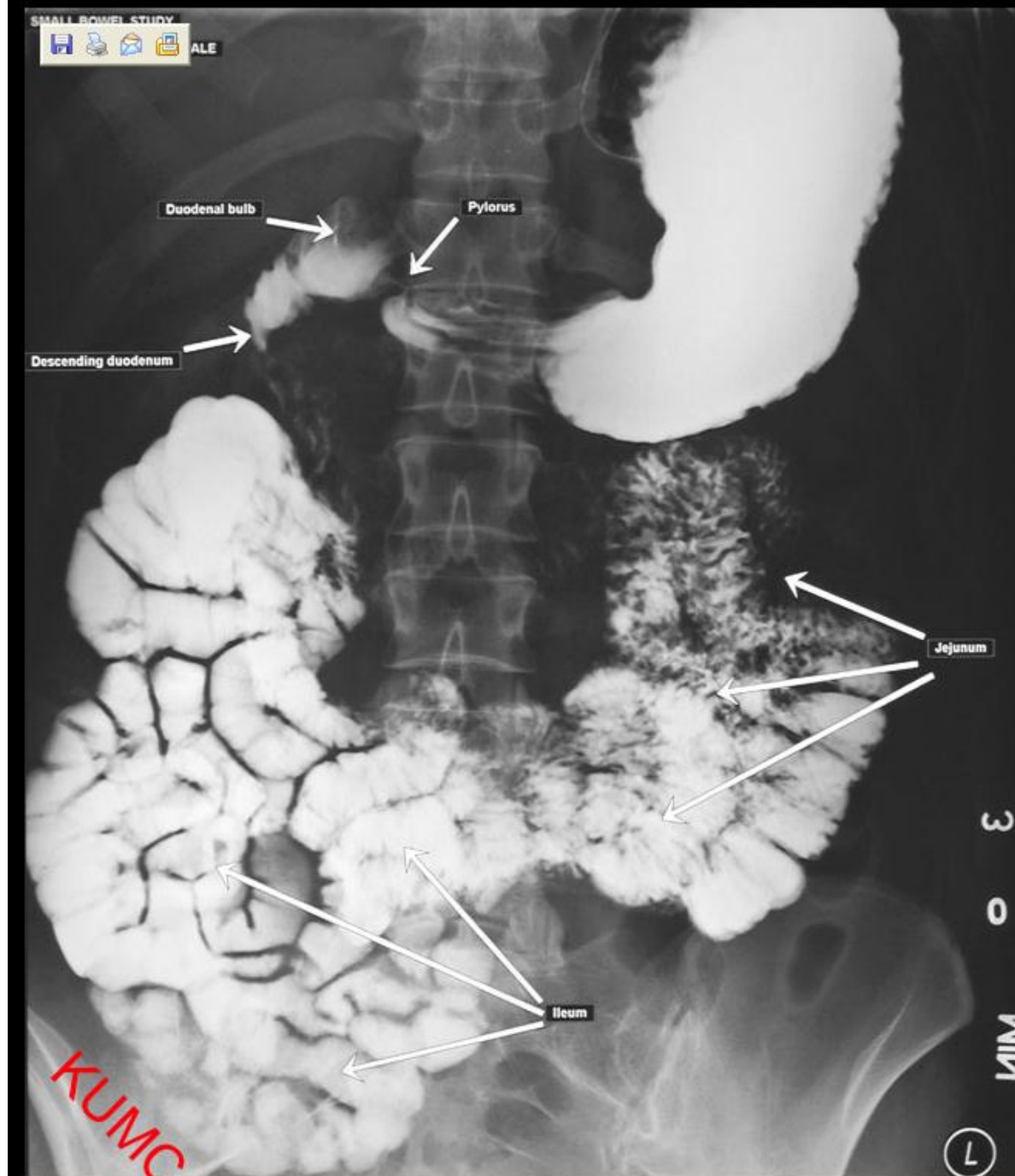




Barium Follow-Through

- Used to examine duodenum, jejunum and ileum
- Like a barium swallow but images taken every 20 minutes or so for 2-3 hours
- Small bowel follow-through may reveal evidence of disorders such as Crohn's disease, Coeliac disease or small bowel tumours





Barium Meal + Follow-Through (Erect Position)

DJJ:
Normal Position= Left side

Duodenal Cap

Pyloric Canal

**2nd Part of
Duodenum**

**3rd Part of
Duodenum**

Ileum

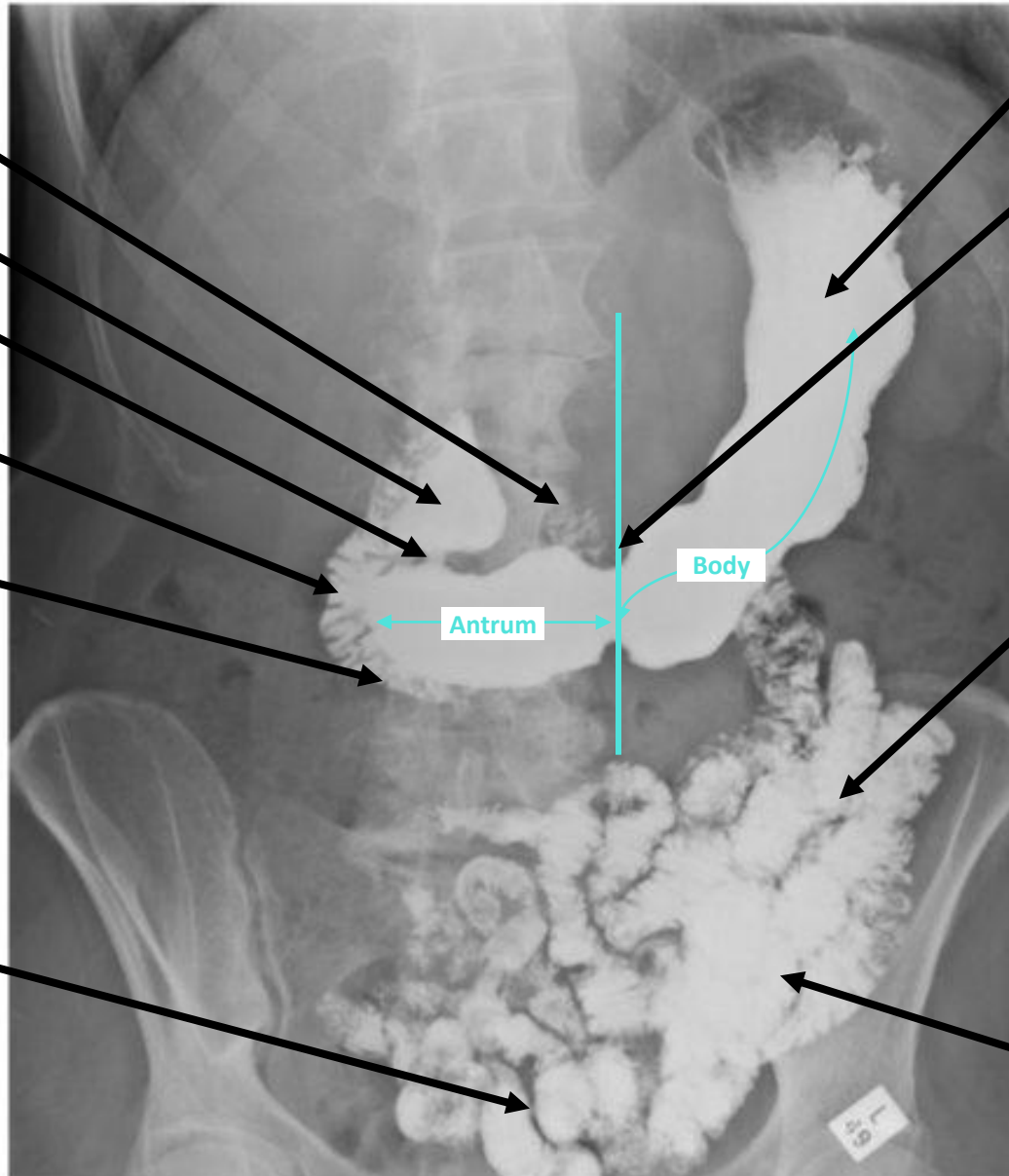
Barium Meal

Angular Notch
Incisura Angularis

Jejunum:

Plica Circularis on the outer
border

**Barium
Follow-Through**



Barium Follow-Through to Cecum (Erect Position)

2nd Part of
Duodenum

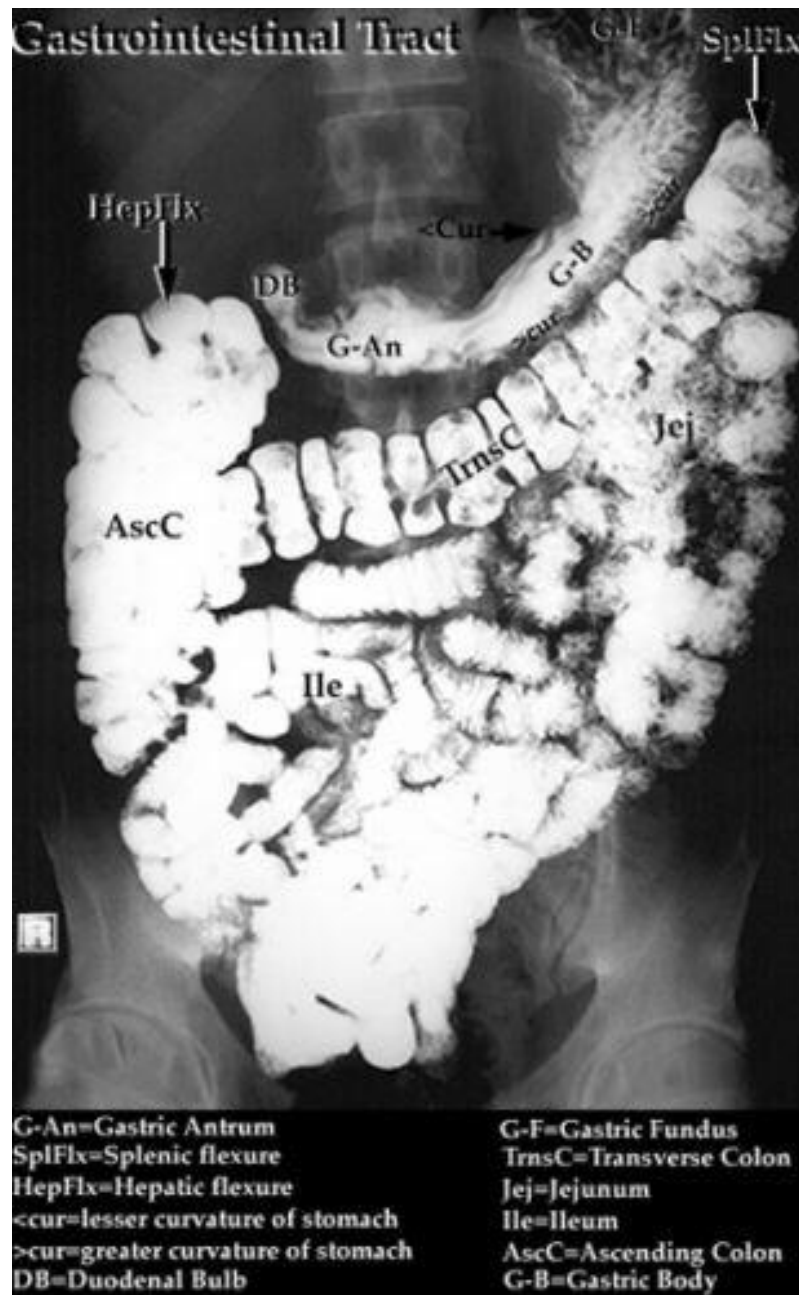
3rd Part of
Duodenum



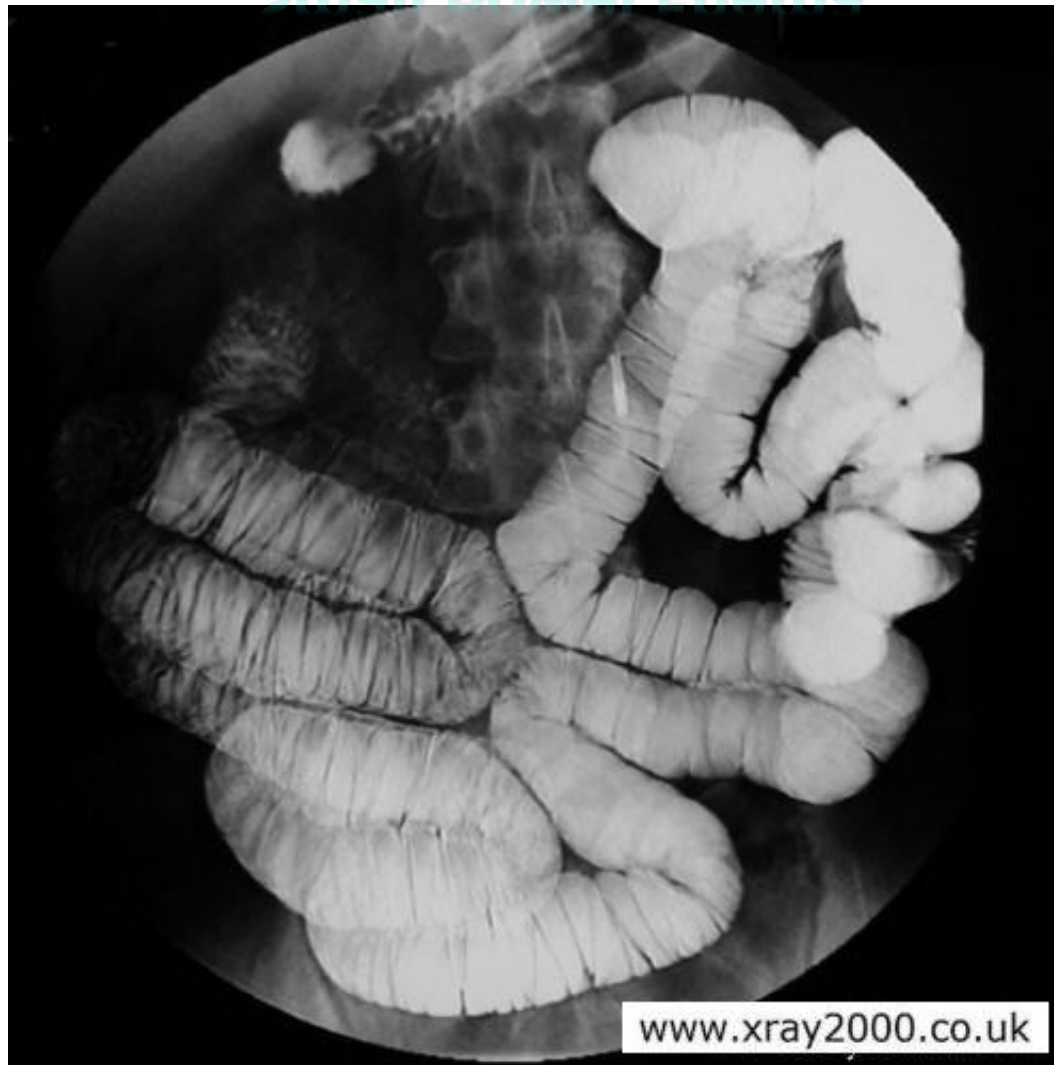
DJJ:

Normal Position= Left side

Barium Follow-through



Small Bowel Enema



A Modified Follow-Through which is called **Small Bowel Enema** note that the bowel is more distended here

This procedure involves inserting a thin tube through the mouth, esophagus and past the stomach to inject barium, methylcellulose and water into the small bowel. This allows for better visualization of the small bowel than can be seen during a small bowel follow-through

Barium Enema

- Single or double contrast study.
- Double contrast means air fired up after barium – pictures may show coating on the outline of the bowel rather than a white bowel (right)
- Patient has to have:
 - low residue diet for three days before the procedure
 - laxatives 24 hr before
 - bowel prep just before
- Barium up the bum, patient has to move into different positions to coat to the whole colon. Often the table moves about to help the passage of barium. Serial X-rays are taken
- Films can be small and only cover a small area of bowel



This is normal, despite the arrows!

Barium Enema, Single Contrast

Ascending
Colon

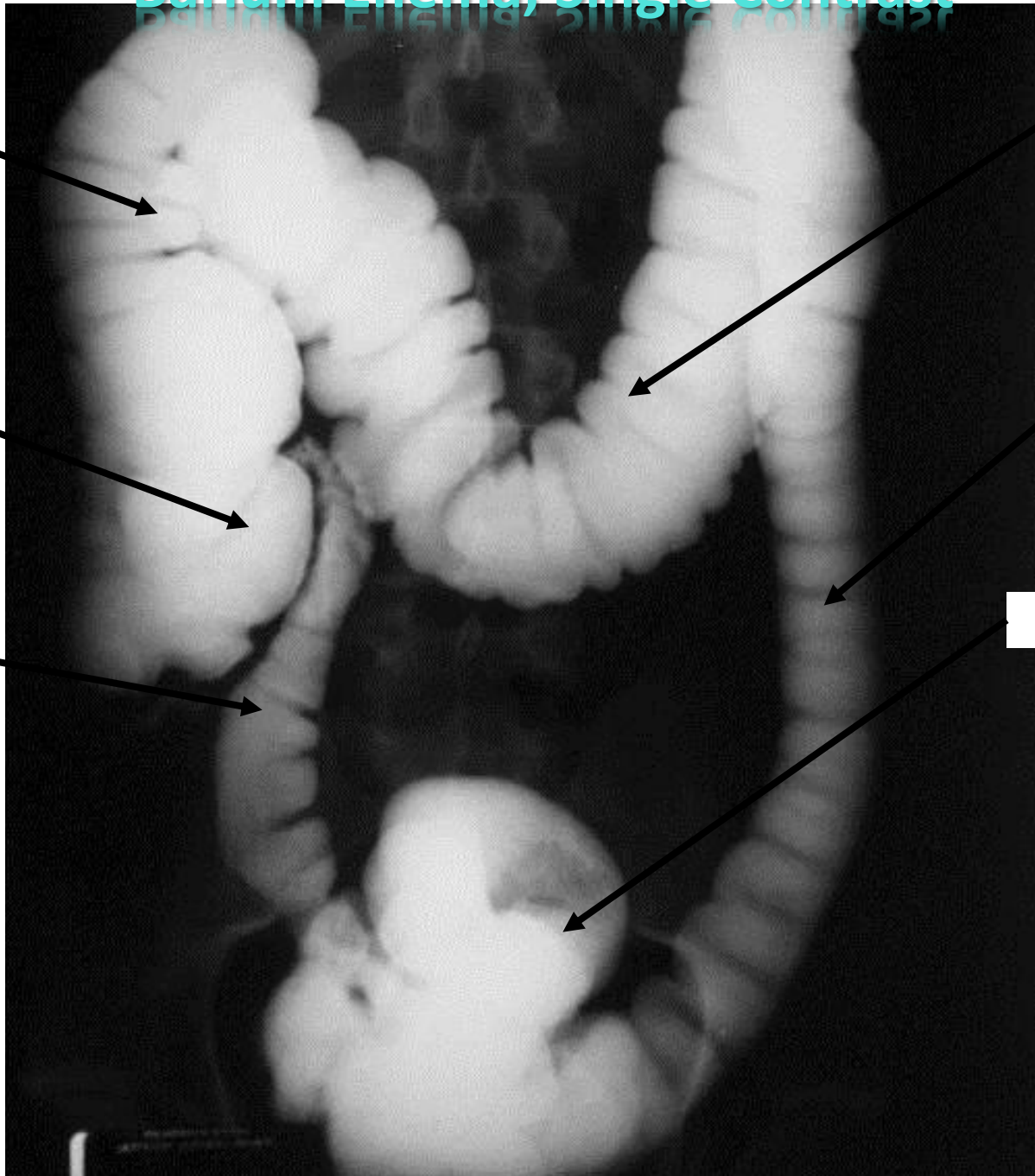
Transverse
Colon

Cecum

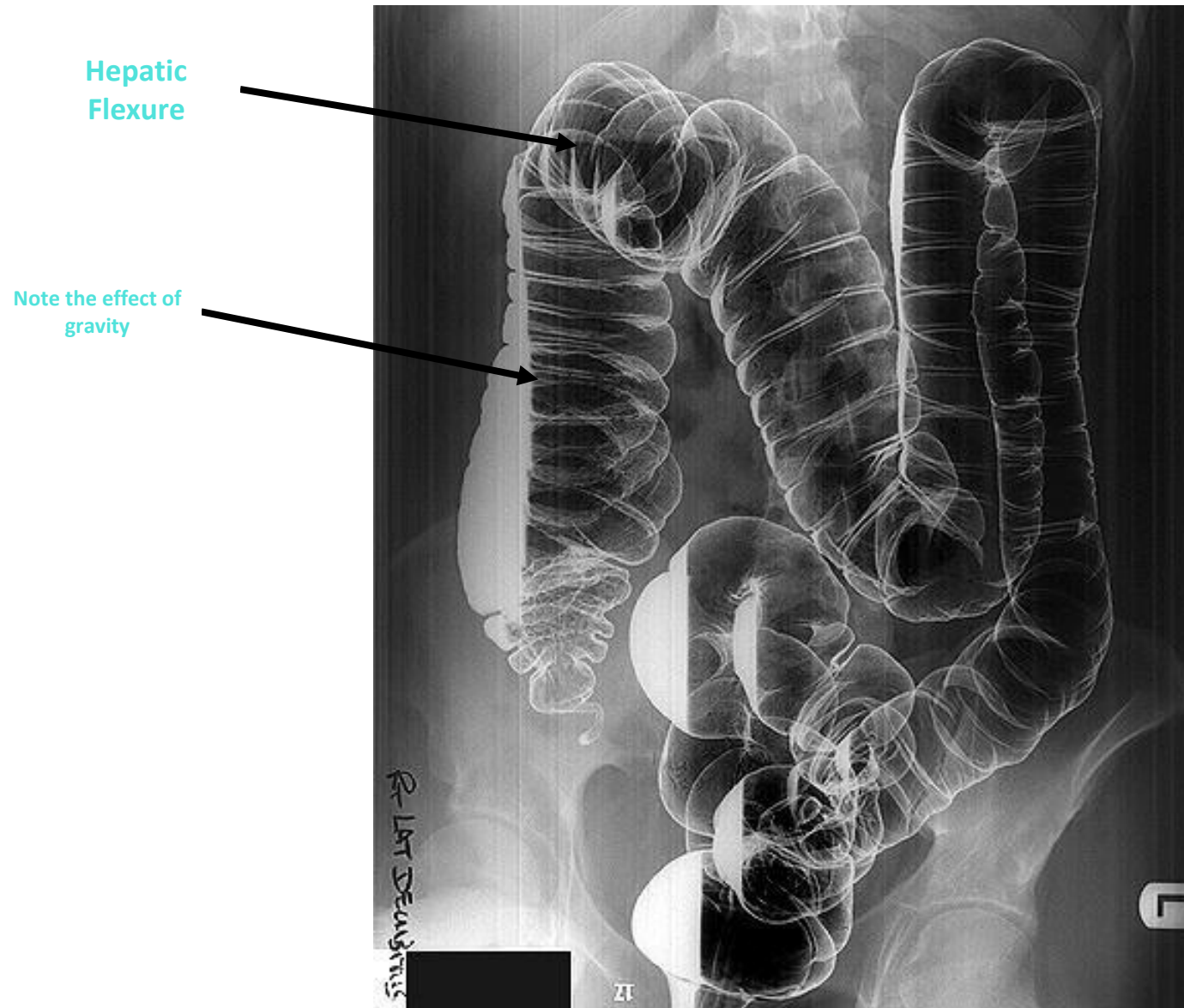
Descending
Colon

Terminal
Ileum

Sigmoid

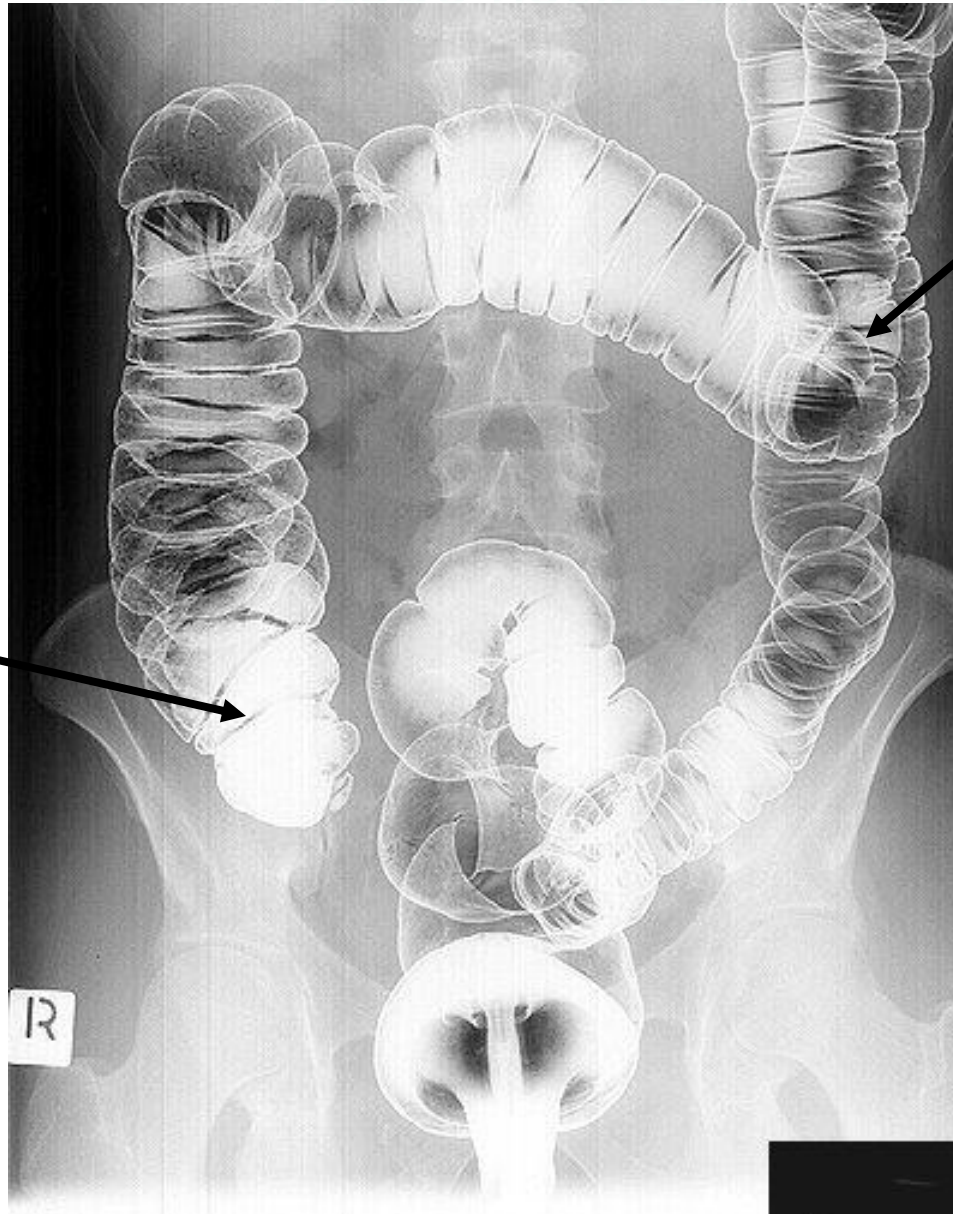


Barium Enema, Double Contrast (Right Lateral Decubitus)



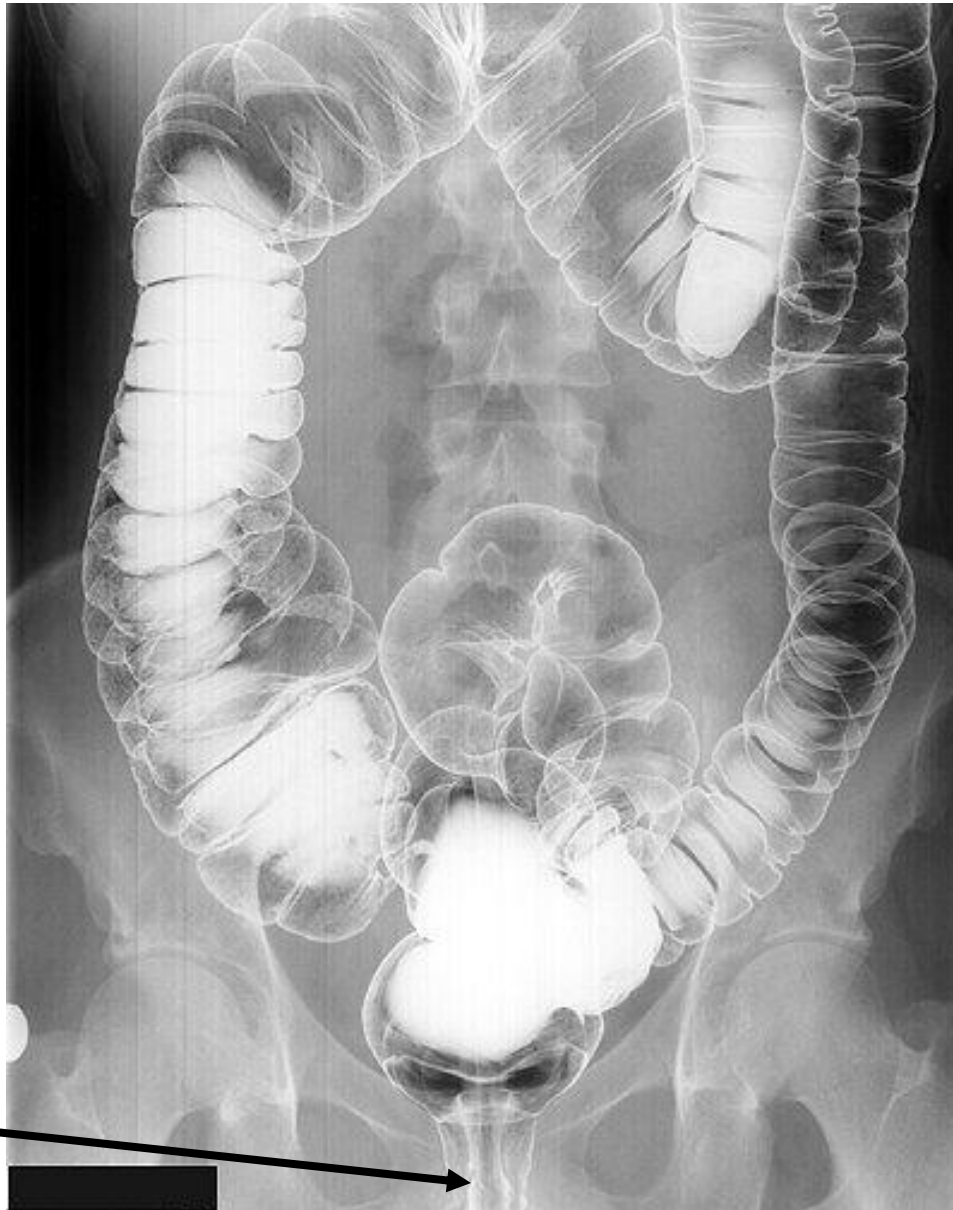
Barium Enema, Double Contrast (Prone Position)

Cecum

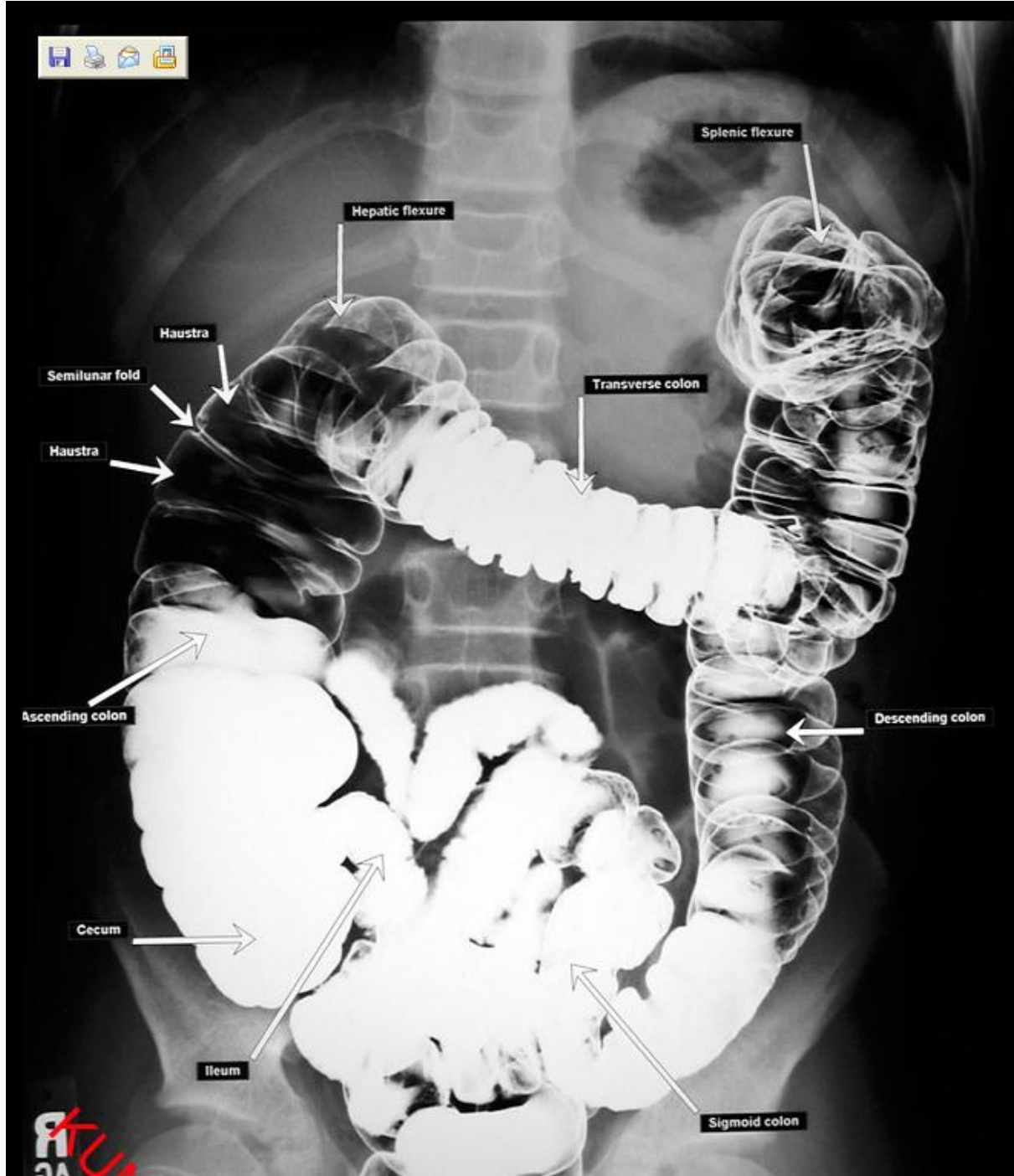


Note the
Haustrations
If lost → UC (IBD)

Barium Enema, Double Contrast (Supine Position)



Rectum



COMPUTED TOMOGRAPHY

COMPUTED TOMOGRAPHY

CT provides cross-sectional images of abdominal organs and structures. Multiple x-ray images are taken from many different angles, digitized in the computer, reconstructed, and then viewed on a computer monitor.

COMPUTED TOMOGRAPHY

Indications for abdominal CT scanning include diseases of the liver, spleen, kidney, pancreas, and pelvic organs. It is a valuable tool in detecting and localizing many inflammatory conditions in the colon, such as appendicitis, diverticulitis, regional enteritis, and ulcerative colitis.

COMPUTED TOMOGRAPHY

Instruct the patient not to eat or drink for 6 to 8 hours before the test.

If the patient is prescribed with intravenous or oral contrast agents, question the patient about contrast dye allergies.

Schedule barium studies after CT scanning, so as not to interfere with imaging.

A 185

DFOV 37.1cm
STND

512

R
1
7
3

L
1
9
8

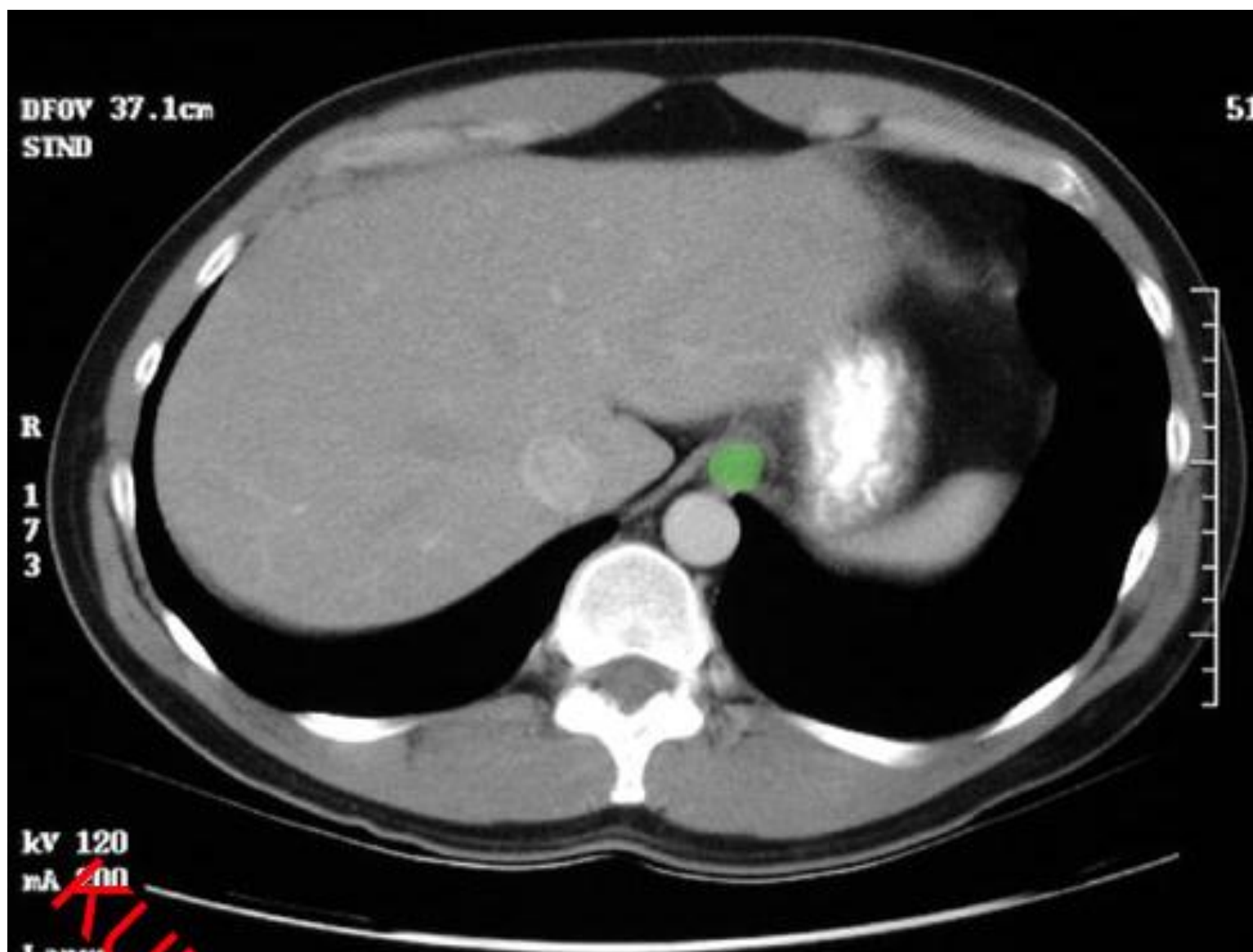
kV 120
mA 200

Large
10.0 mm/1.01
Tilt : 0.0

AXIAL



P 185



A 185

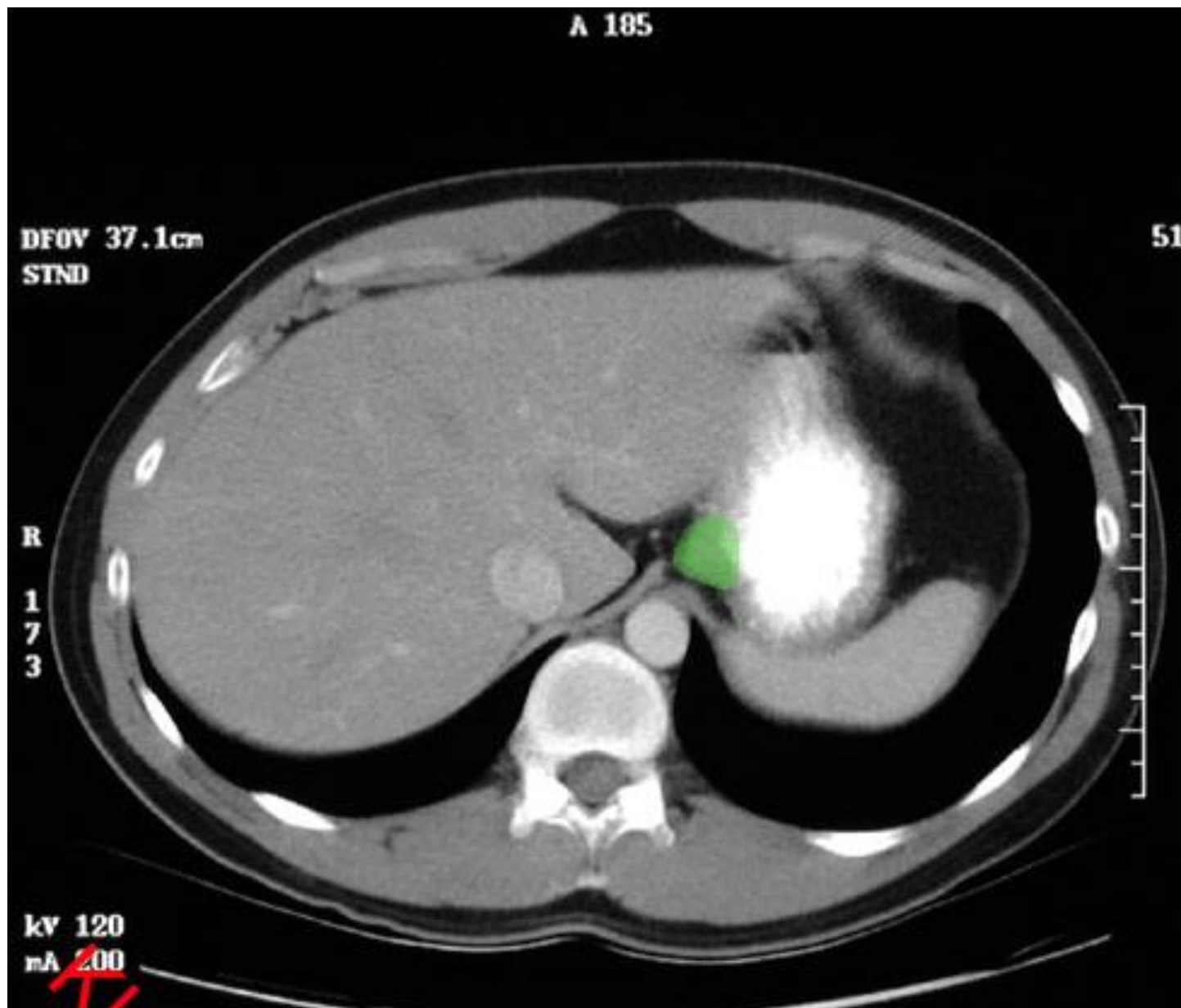
DFOV 37.1cm
STND

51

R

1
7
3

kV 120
mA ~~200~~



A 185

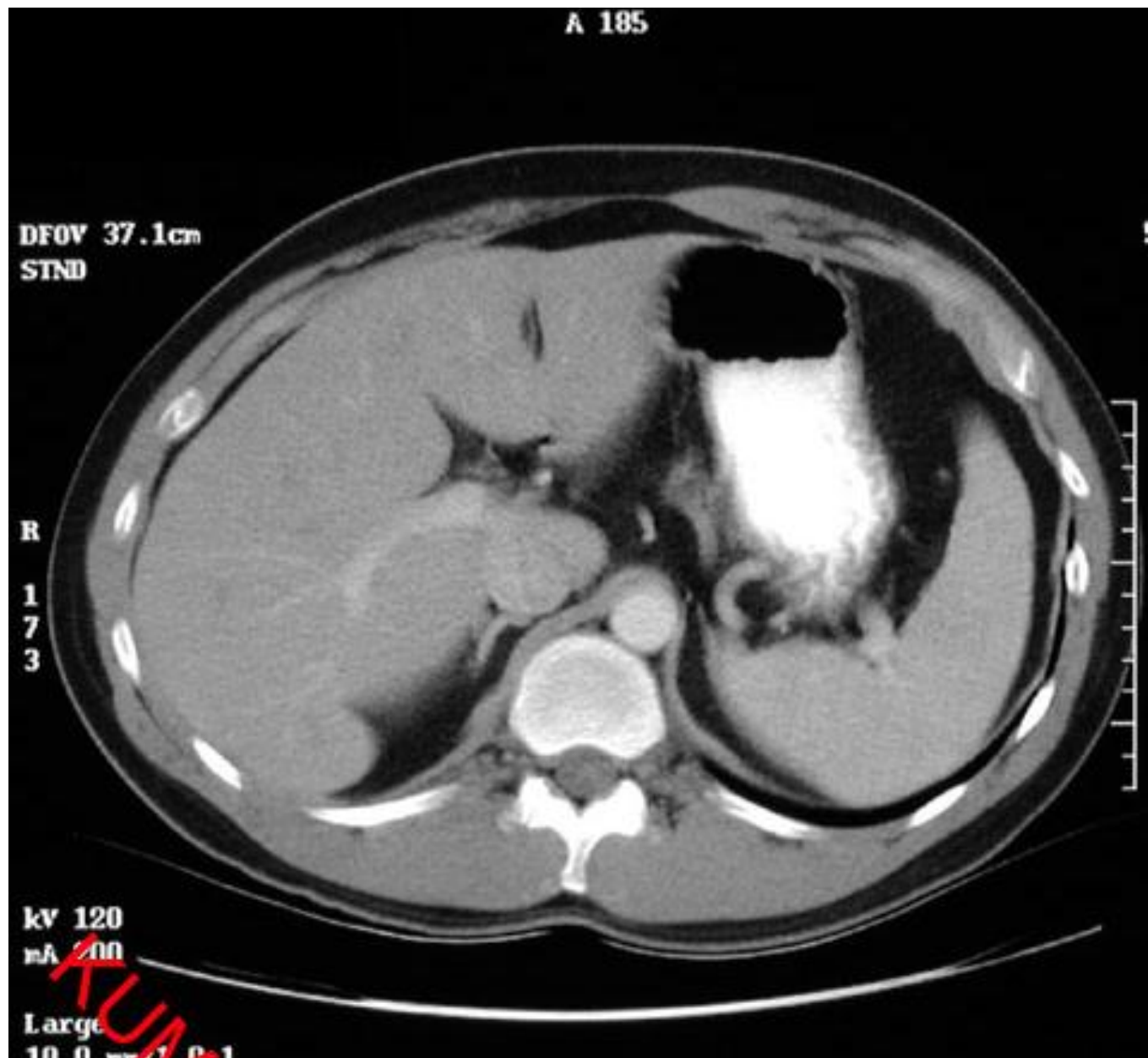
DFOV 37.1cm
STND

R

1
7
3

kV 120
mA 200

Large
10.0 mm 1.0 mm



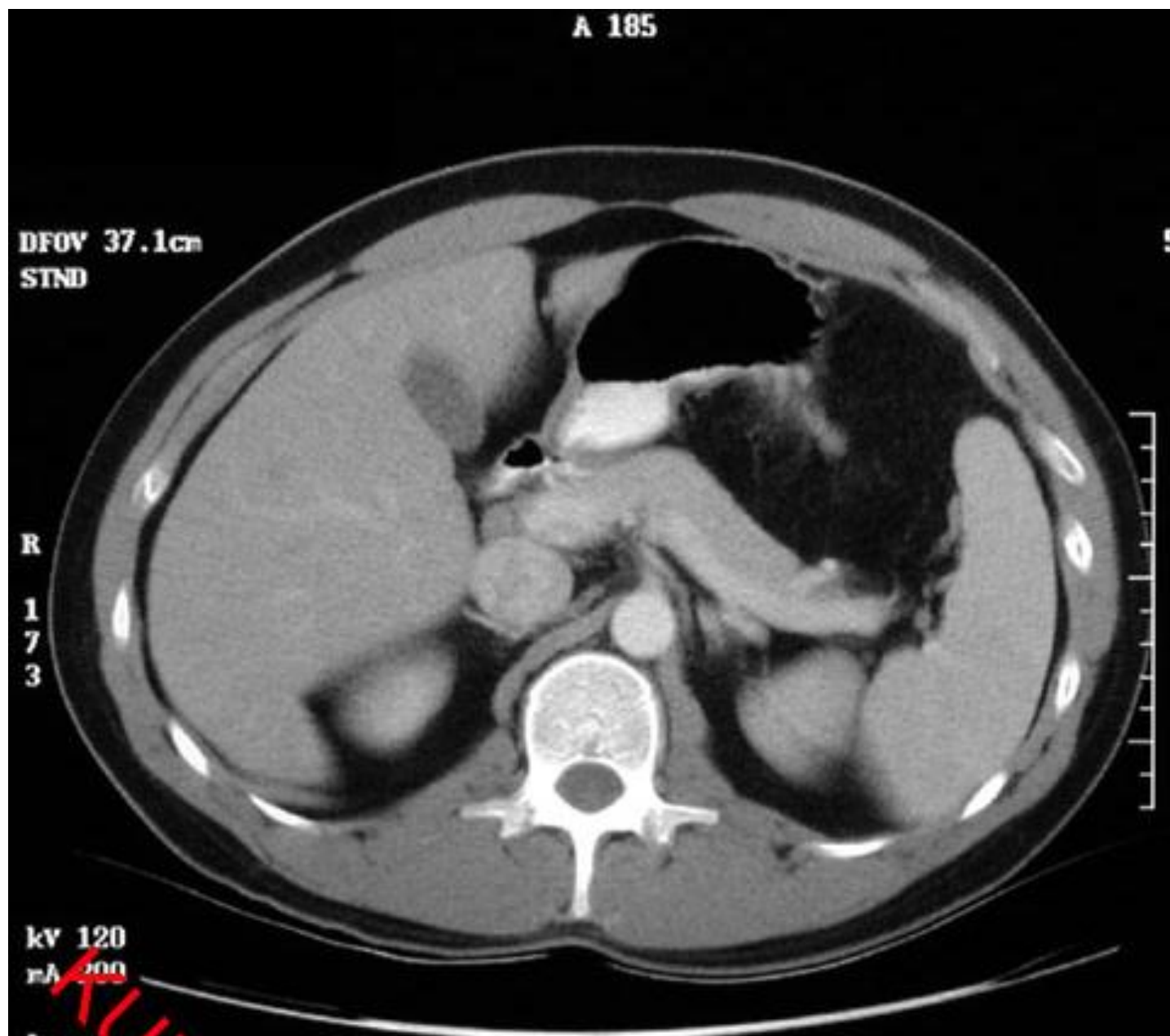
A 185

DFOV 37.1cm
STND

R

1
7
3

kV 120
mA 200



A 185

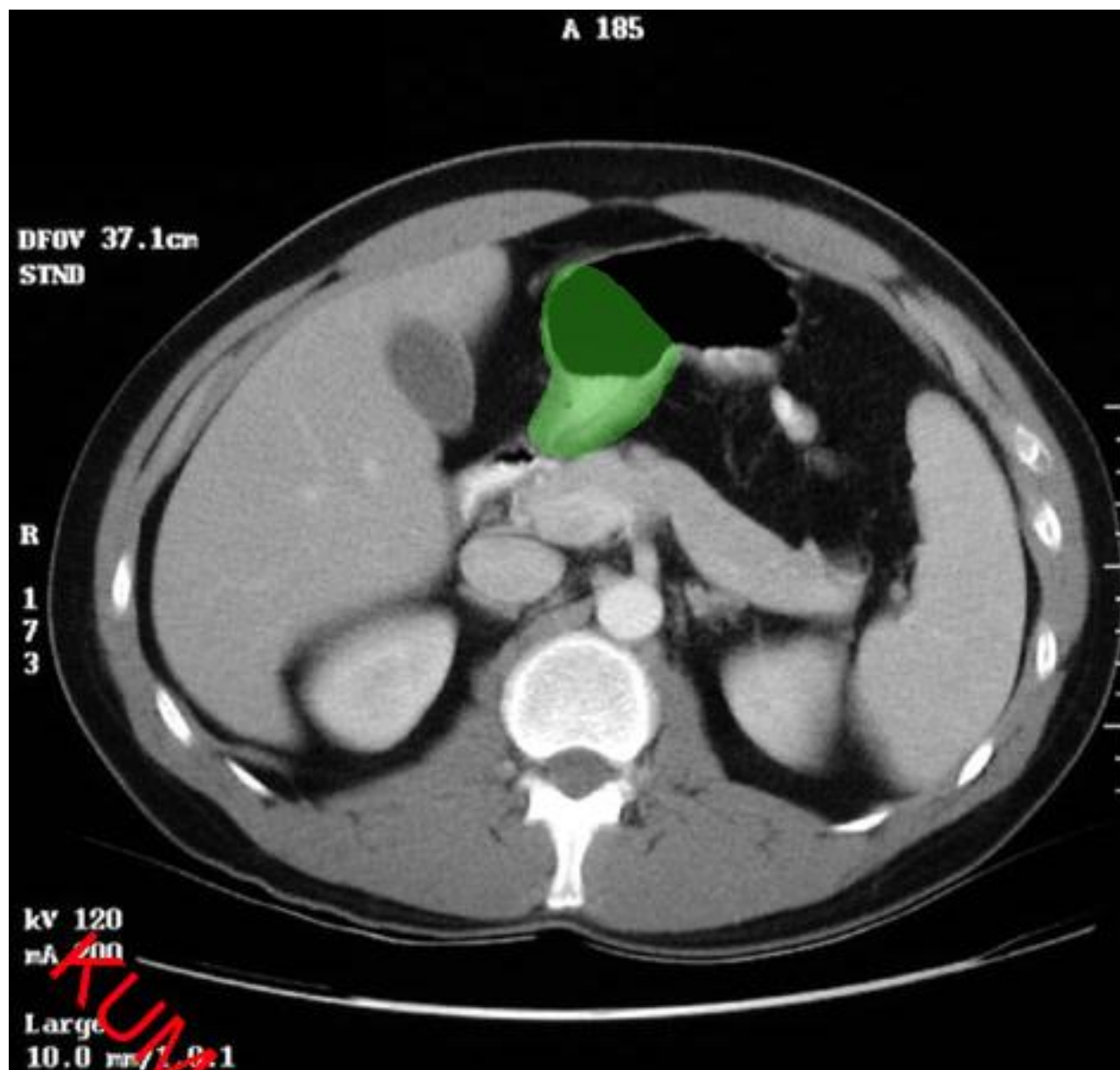
DFOV 37.1cm
STND

R

1
7
3

kV 120
mA 200

Large
10.0 mm/1.0:1



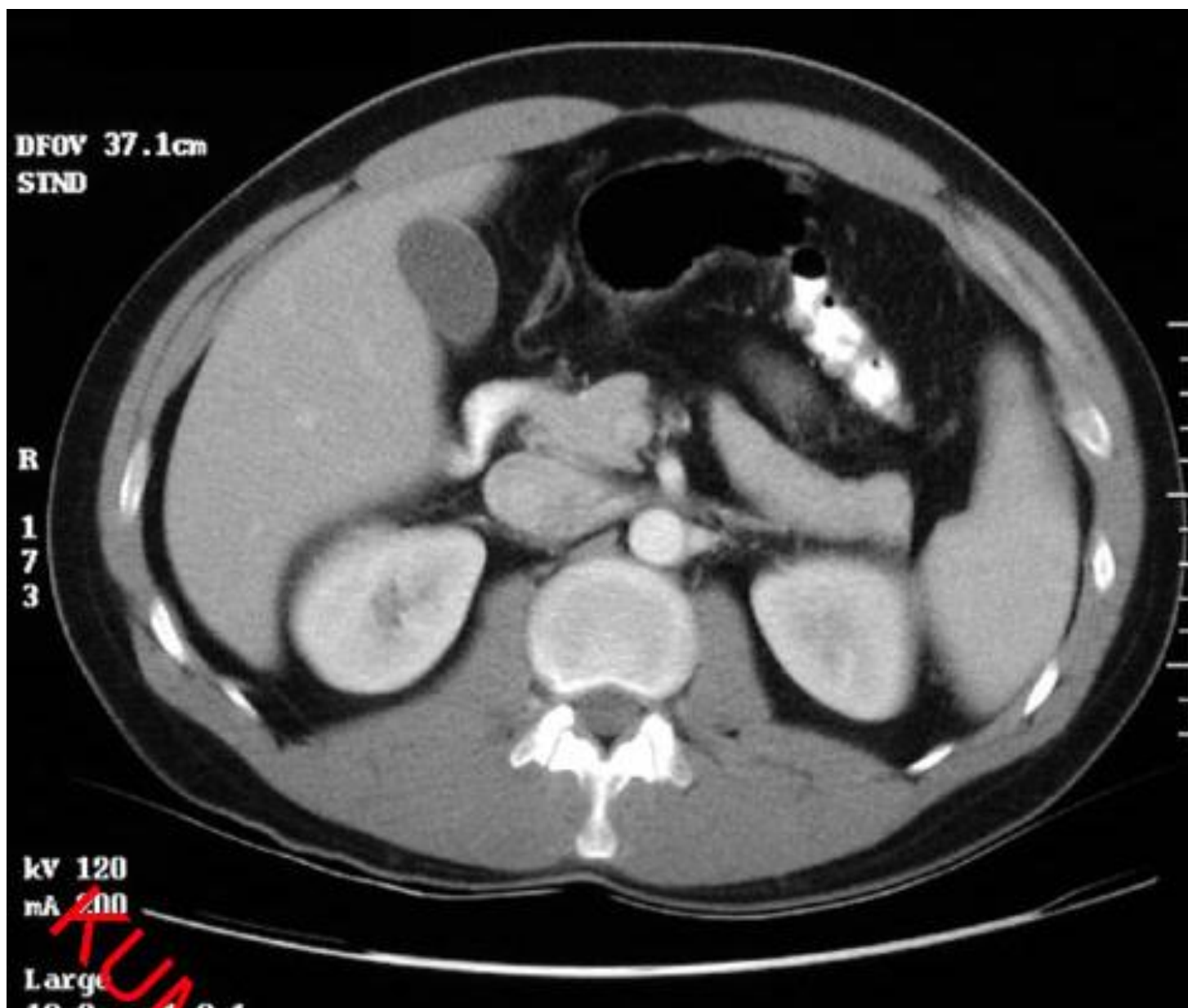
DFOV 37.1cm
STND

R
1
7
3

kV 120
mA 200

Large

10.0 10.0 10.0



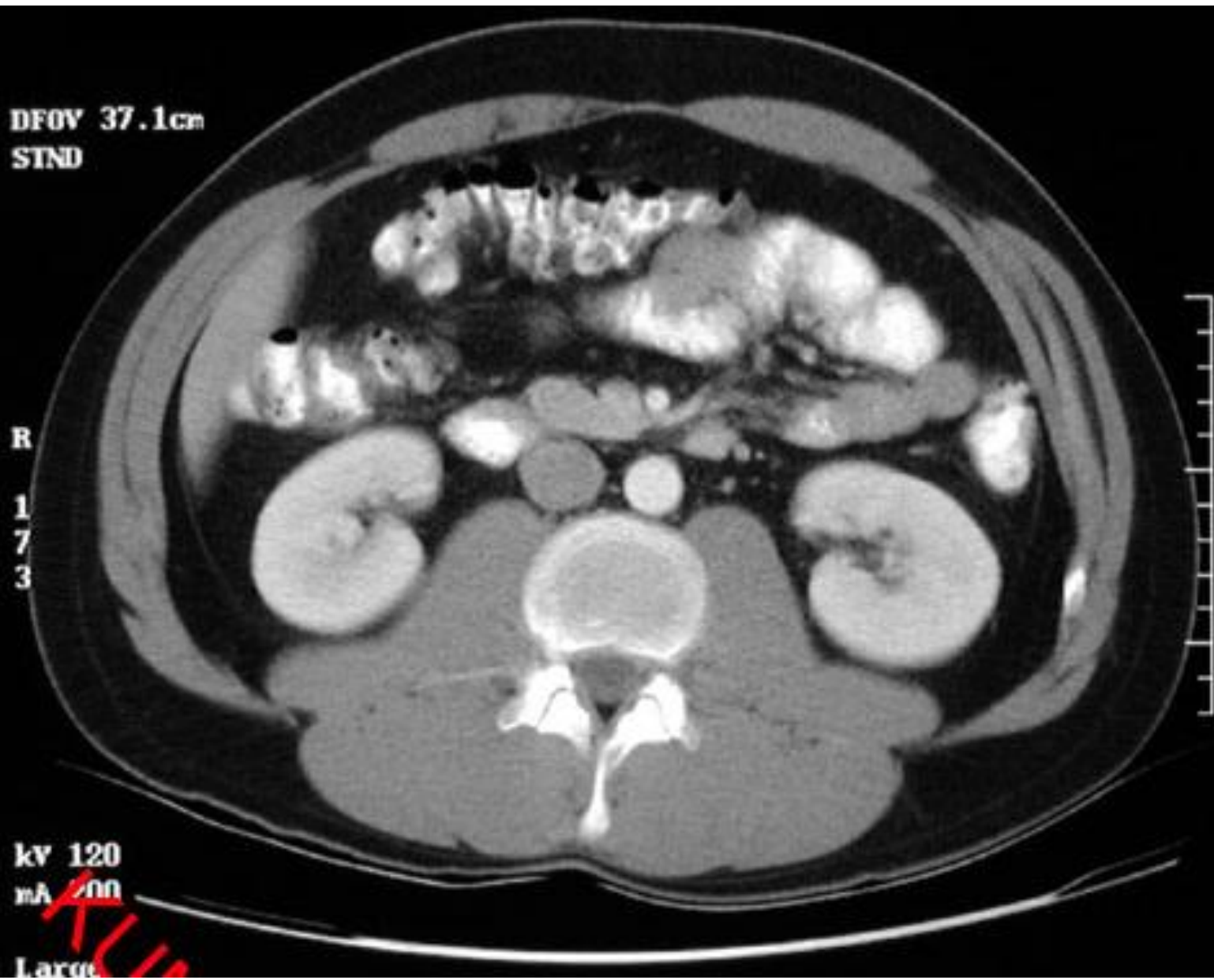
DFOV 37.1cm
STND

R

1
7
3

kV 120
mA 200

LARGE

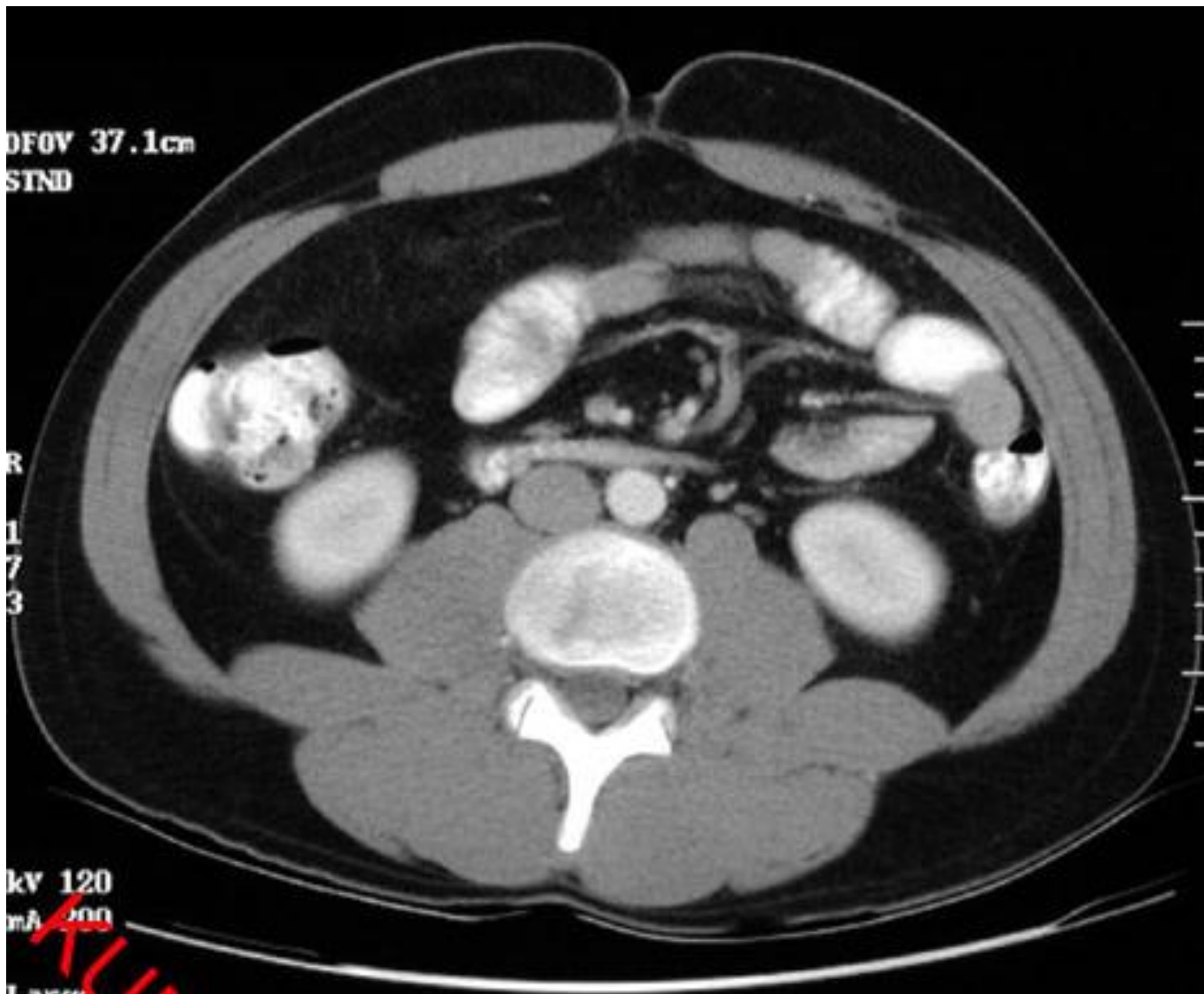


FOV 37.1cm
STND

R
1
7
3

kV 120
mA 200

1.000



CT PELVIS
WITH CONTRAST
28 YR OLD MALE

DFOV 37.1cm
STND

R
1
7
3

kV 120
mA 200

Large

10 0 0.1



CT PELVIS
WITH CONTRAST
28 YR OLD MALE

A 100

FOV 37.1cm
STND

R

1

7

3

kV 120
mA 200

Large



CT PELVIS
WITH CONTRAST
28 YR OLD MALE

DFOV 37.1cm
STND

R
1
7
3

kV 120
mA 200

Large



CT PELVIS
WITH CONTRAST
28 YR OLD MALE

DFOV 37.1cm
STND

R
1
7
3

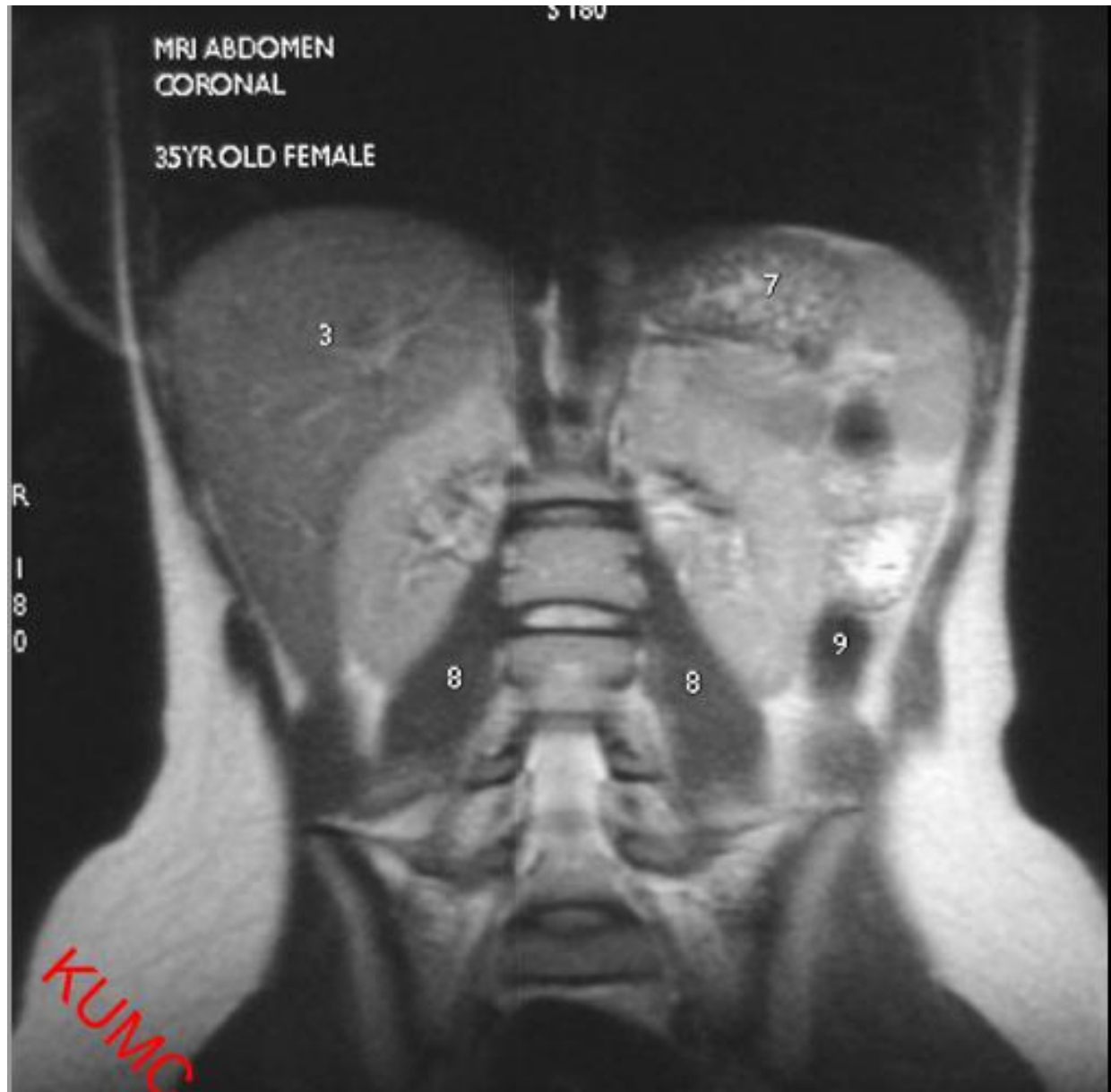
kV 120
mA 200

Large
10.0 mm 1.0:1



MAGNETIC RESONANCE IMAGING

MRI is useful in evaluating abdominal soft tissues as well as blood vessels, abscesses, fistulas, neoplasms, and other sources of bleeding.



ANATOMICAL FEATURES:

1. Erector spinae muscles
2. Spinal canal
3. Right lobe of liver
4. Spleen
5. Right kidney
6. Left kidney
7. Stomach
8. Psoas major muscle
9. Descending colon
10. Sigmoid colon

MRI ABDOMEN
CORONAL

35YR.OLD FEMALE

10

11

10. Splenic
flexure of colon

11. Jejunum

12. Ileocecal junction

KUMC

S 180

MRI ABDOMEN
CORONAL

35YR. OLD FEMALE

R
1
8
0



7

11

- 6. Left kidney
- 7. Stomach
- 8. Psoas major muscle
- 9. Descending colon
- 10. Splenic flexure of colon
- 11. Jejunum
- 12. Hepatic veins
- 13. Iliac vessels

KUMC

MRI ABDOMEN
CORONAL

35YR OLD FEMALE



3. Right lobe of liver
4. Spleen
5. Right kidney
6. Left kidney
7. Stomach
8. Psoas major muscle
9. Descending colon
10. Splenic flexure of colon
11. Jejunum
12. Hepatic veins
13. Inferior vena cava
14. Aorta
15. Left lobe of liver
16. Portal vein
17. Ascending colon
18. Left common iliac artery
19. Right common iliac artery

MRI ABDOMEN
CORONAL

35YR.OLD FEMALE

3

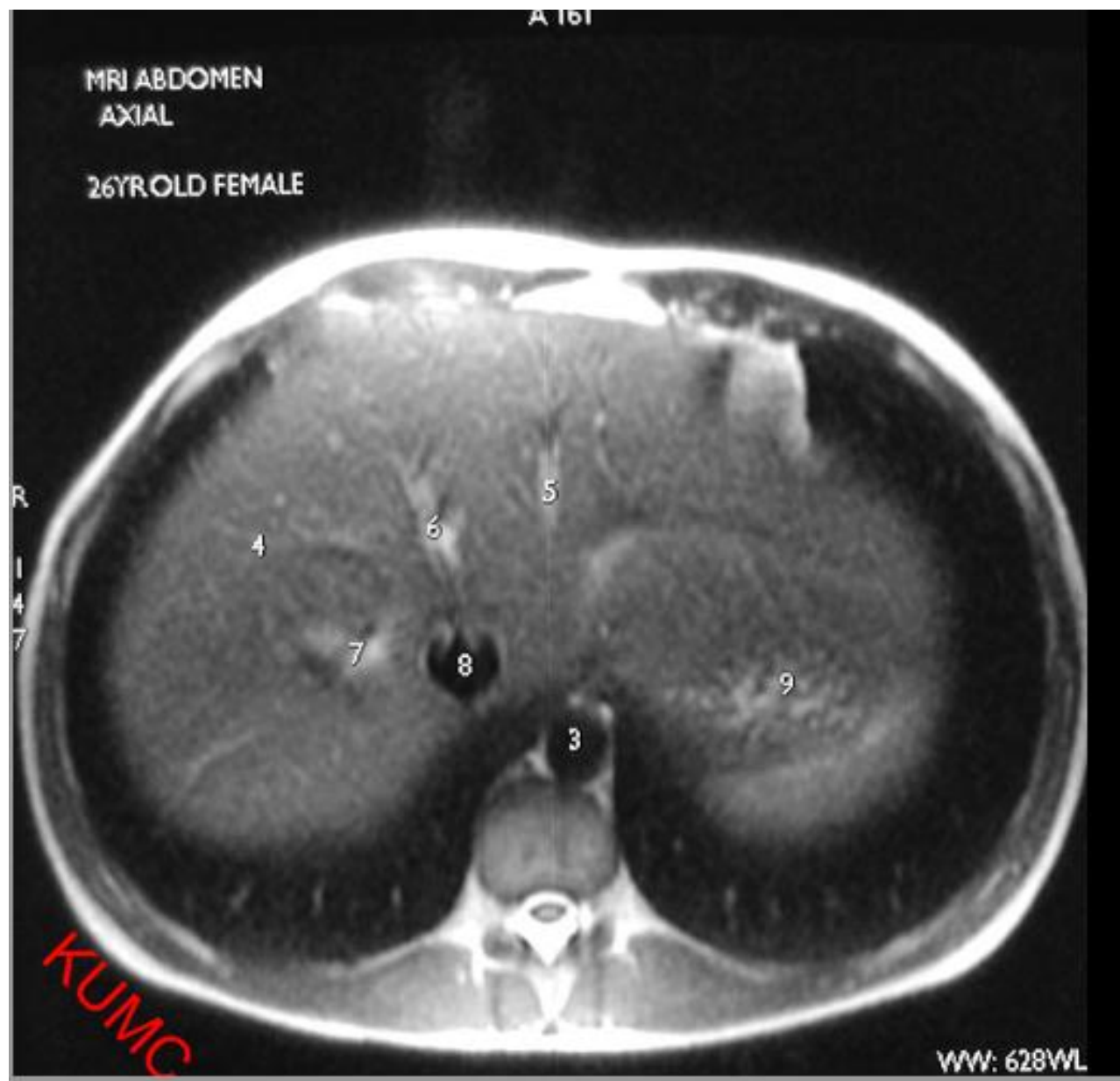
7

21

R
1
8
0

KUMC

7. Stomach
8. Psoas major muscle
9. Descending colon
10. Splenic flexure of colon
11. Jejunum
12. Hepatic veins
13. Inferior vena cava
14. Aorta
15. Left lobe of liver
16. Portal vein
17. Ascending colon
18. Left common iliac artery
19. Right common iliac artery
20. Ileum
21. Transverse colon



- 3. Aorta
- 4. Liver
- 5. Left hepatic vein
- 6. Middle hepatic vein
- 7. Right hepatic vein
- 8. Inferior vena cava
- 9. Stomach
- 10. Spleen



ANATOMICAL FEATURES:

1. Right ventricle
2. Left ventricle
3. Aorta
4. Liver
5. Left hepatic vein
6. Middle hepatic vein
7. Right hepatic vein
8. Inferior vena cava
9. Stomach
10. Spleen
11. Right crus of diaphragm

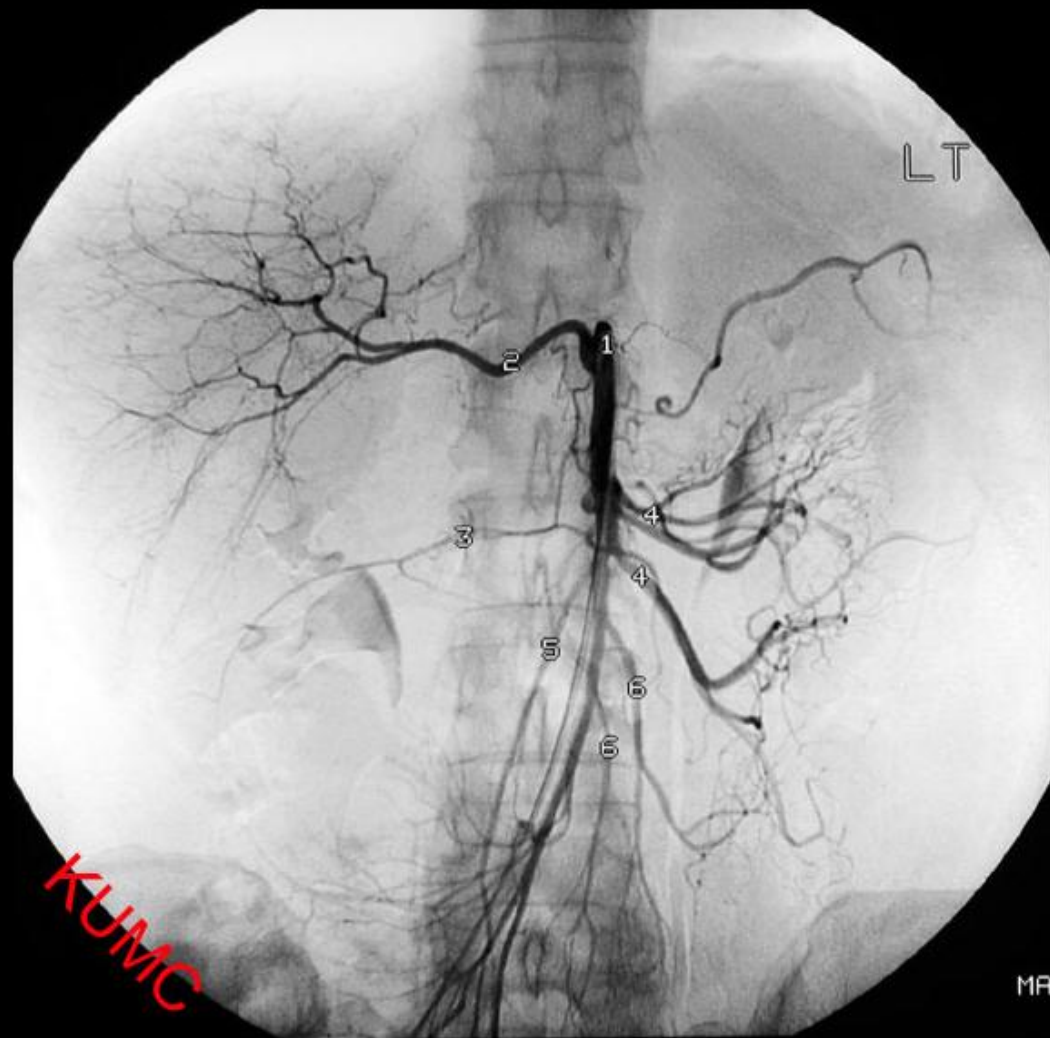


- 18. Right kidney
- 19. Left kidney
- 20. Head of pancreas
- 21. Jejunum
- 22. C-11: 1-1-1-1



4. Vagina
5. Urinary bladder
6. Pubic bone
7. Vertebral body-L5
8. Sacrum
9. Endocervical canal
10. Rectouterine pouch (cul-de-sac of Douglas)
11. Anal canal
12. Vesicouterine pouch
13. Urethra
14. Endometrium
15. Coccyx
16. Sacral

Angiography



ROT
0

ANG
0

1 Superior mesenteric artery (SMA)

2 Replaced right hepatic artery

3 Right colic artery

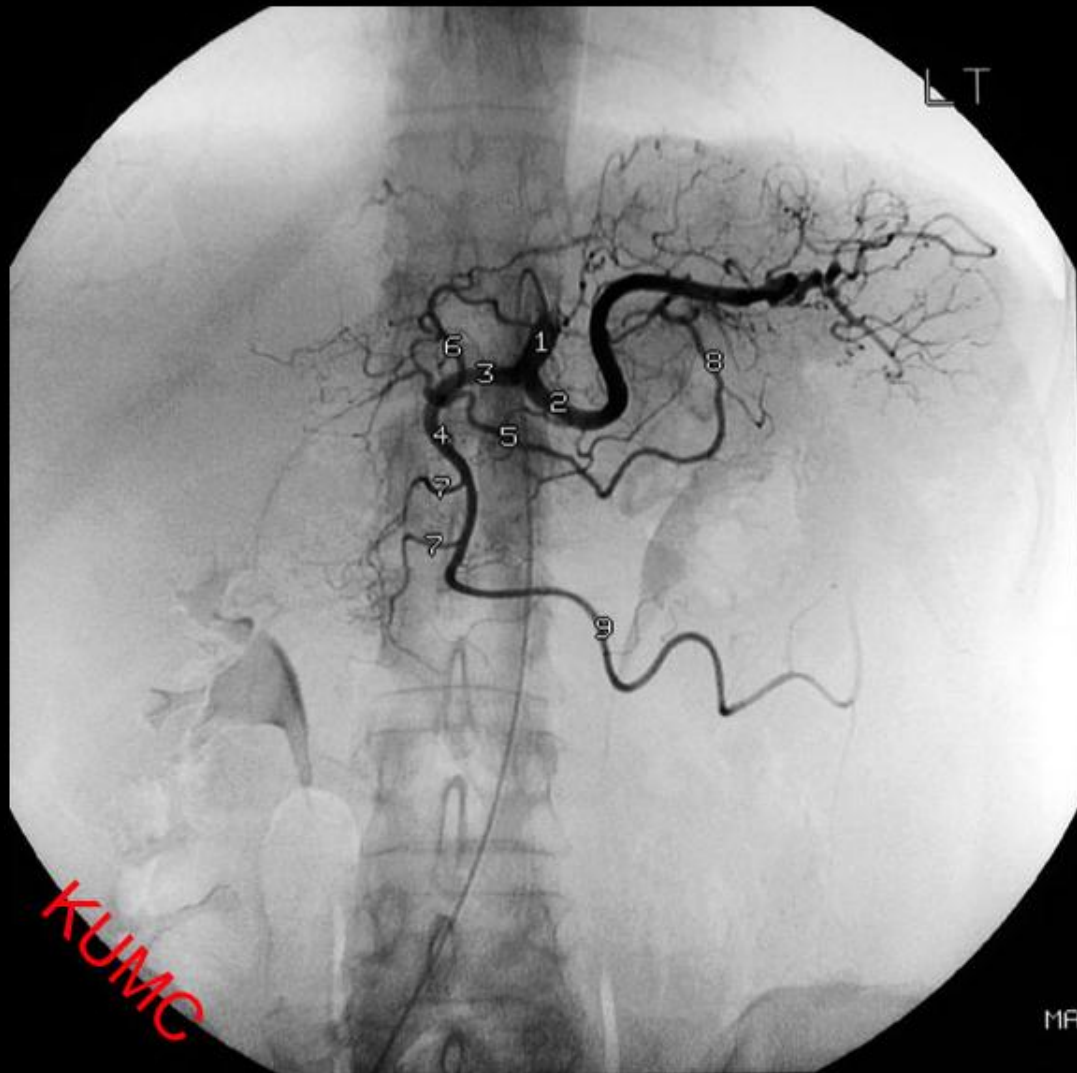
4 Jejunal (intestinal) arteries

5 Ileocolic artery

6 Ileal (intestinal) arteries

RUN
6

19
MASK IMAGE
4 12



Right hepatic artery is replaced and originates off of SMA (normal variant)

1 Celiac trunk

2 Splenic artery

3 Common hepatic artery

4 Gastroduodenal artery

5 Right gastric artery

6 Left hepatic artery

7 Pancreaticoduodenal arteries

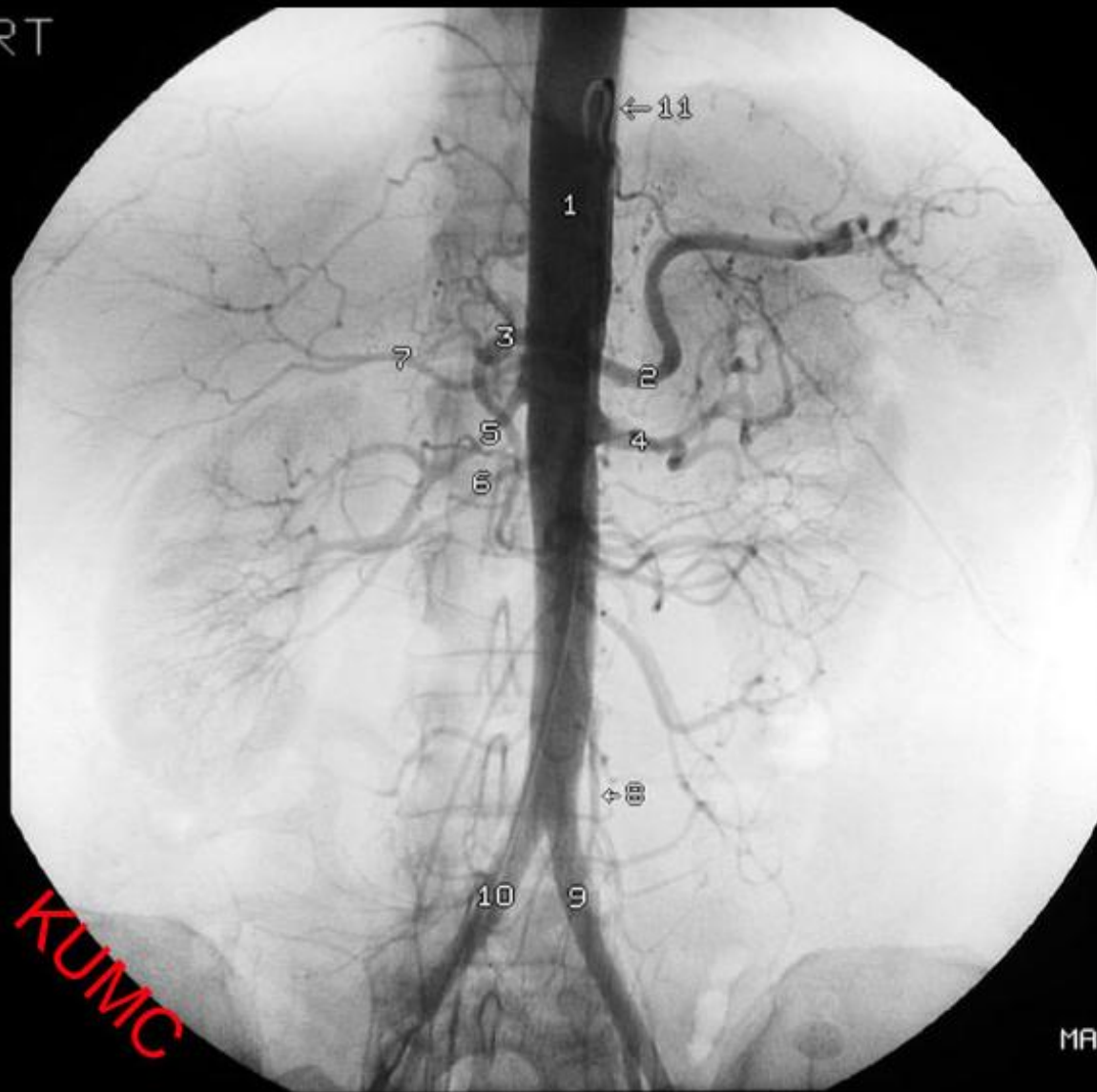
8 Left gastric artery (origin off celiac not visualized)

9 Right gastroepiploic artery



- 1 Abdominal aorta
- 2 Celiac trunk
- 3 Splenic artery
- 4 Common hepatic artery
- 5 Superior mesenteric artery
- 6 Inferior mesenteric artery
- 7 Catheter in lumen of aorta

RT



- 1 Abdominal aorta
- 2 Splenic artery
- 3 Common hepatic artery
- 4 Left renal artery
- 5 Right renal artery
- 6 Accessory right renal artery
- 7 Right hepatic artery
- 8 Inferior mesenteric artery
- 9 Left iliac artery
- 10 Right iliac artery
- 11 Catheter in lumen of aorta

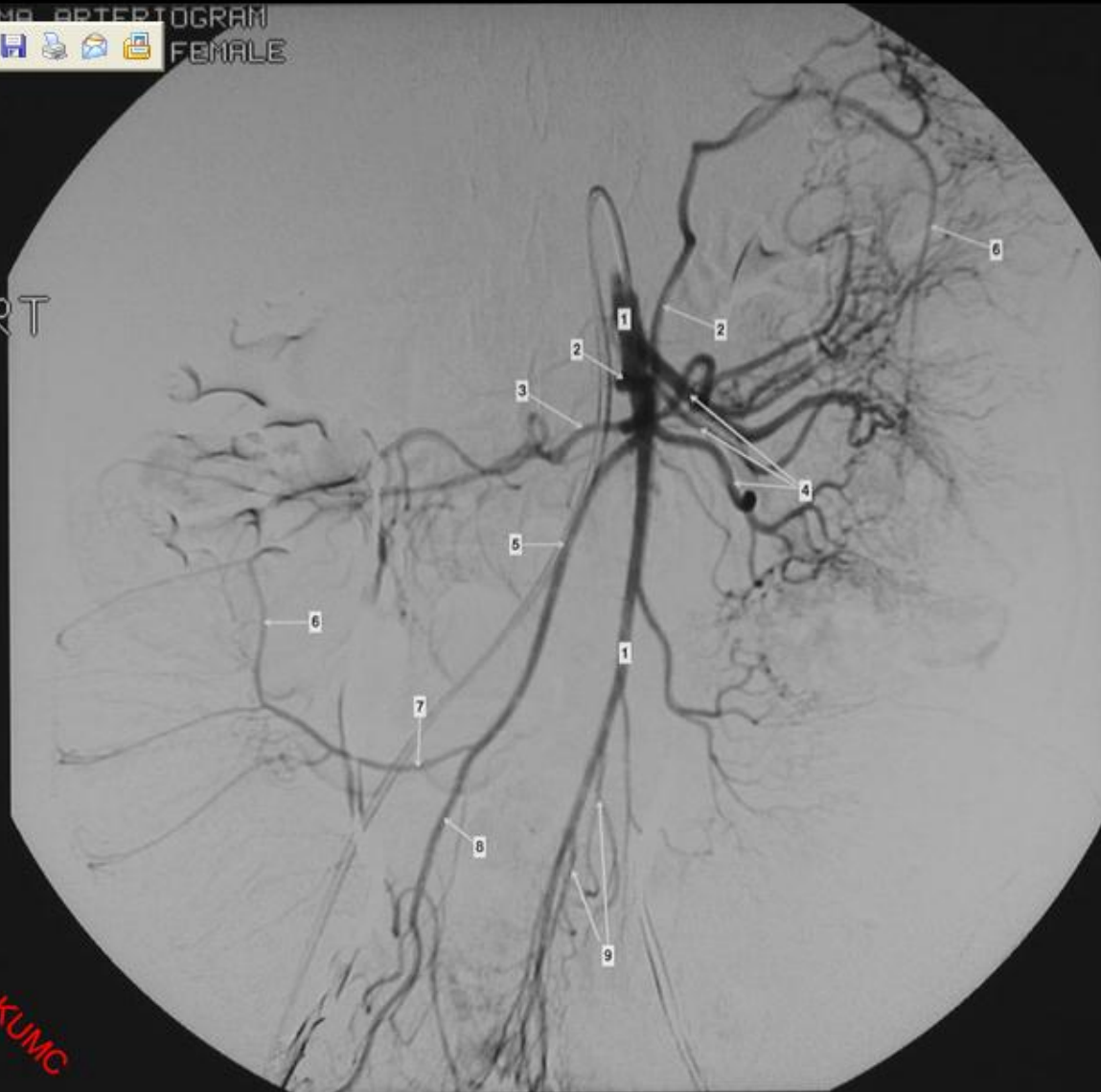
CELIAC ARTERIOGRAM
51 YR OLD FEMALE

RT



- 1 Celiac artery (trunk)
- 2 Left gastric artery
- 3 Common hepatic artery
- 4 Splenic artery
- 5 Hepatic artery proper
- 6 Left hepatic artery
- 7 Right hepatic artery
- 8 Gastroduodenal artery
- 9 Right gastroepiploic artery

RT



- 1 Superior mesenteric artery
- 2 Middle colic artery
- 3 Right colic artery
- 4 Jejunal arteries
- 5 Ileocolic artery
- 6 Marginal artery
- 7 Colic branch of ileocolic artery
- 8 Ileal branch of ileocolic artery
- 9 Ileal arteries

KUMC

Thank You