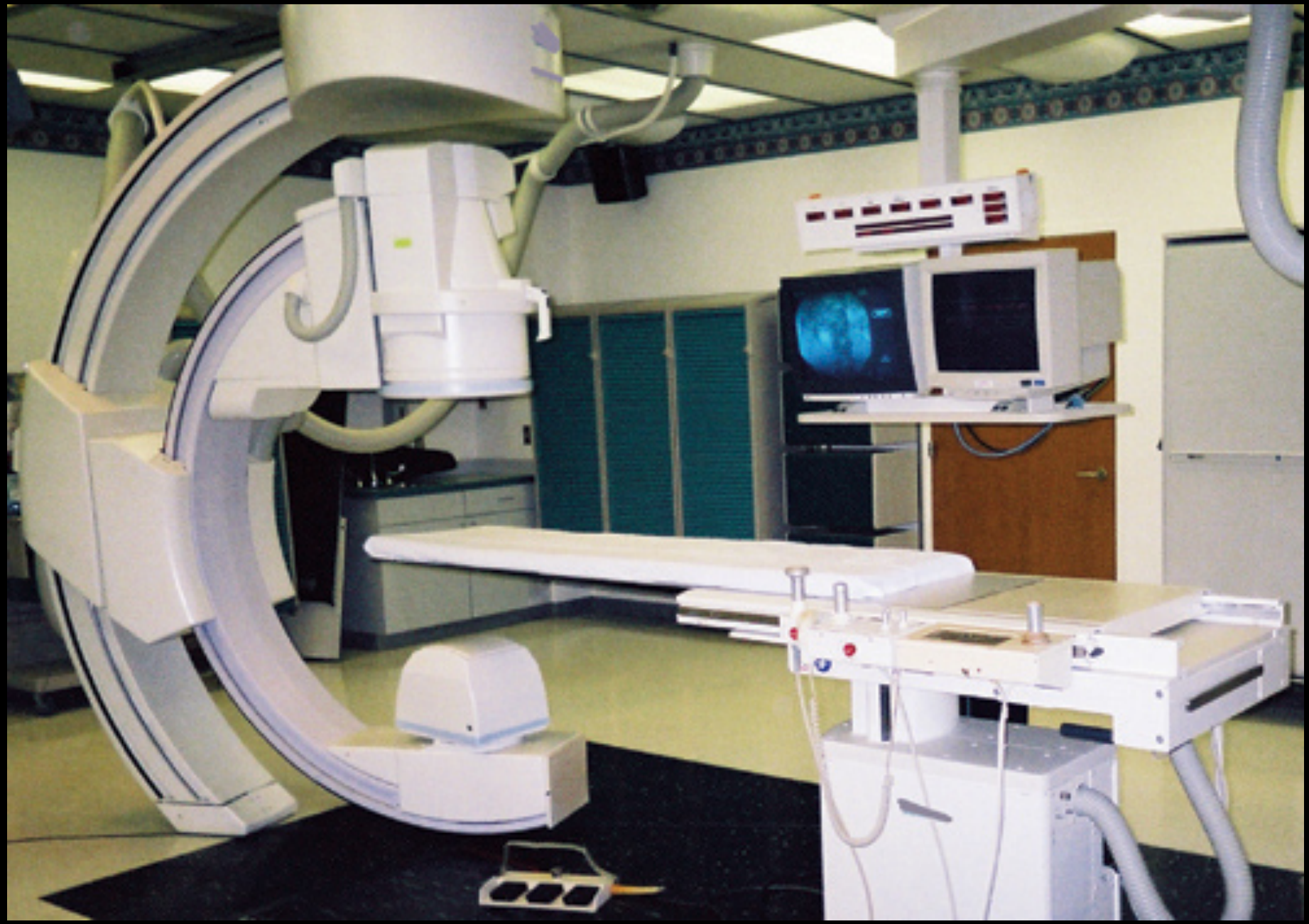
VASCULAR & INTERVENTIONAL RADIOLOGY

JEHAD FATAFTAH, MD



INTERVENTIONAL RADIOLOGY

استخدام الradiology لاجراء العمليات

- **Interventional radiology** is a subspecialty of Radiology and means minimally invasive procedures are performed using **image guidance**. Some of these procedures are done for purely diagnostic purposes (e.g., angiogram), while others are done for treatment purposes (e.g., angioplasty).

What kind of things can be done?

- **Treatment of vascular** problems (embolization or angioplasty, bleeding, AVM, thrombolysis..)
- **Biopsies**
- **Drainage of fluid collections** or abscess
- **Kidneys: Nephrostomy, PCNL, DJ, Renal artery stenting/embolization.**
- **Liver: PTC, TIPS, Chemoembolization**
- **Bowel: Bleeding embolizations, feeding tubes placement**
- **Neuro: AVM , bleeding, back pain management …**
- Uterine fibroid embolization, fallopian tube recanalization

Nephrostomy

→ in case of prostatic hypertrophy

→ in hepatocellular carcinoma

التليفات

fallopian tubes

interventional radiology

These procedures have many advantages:

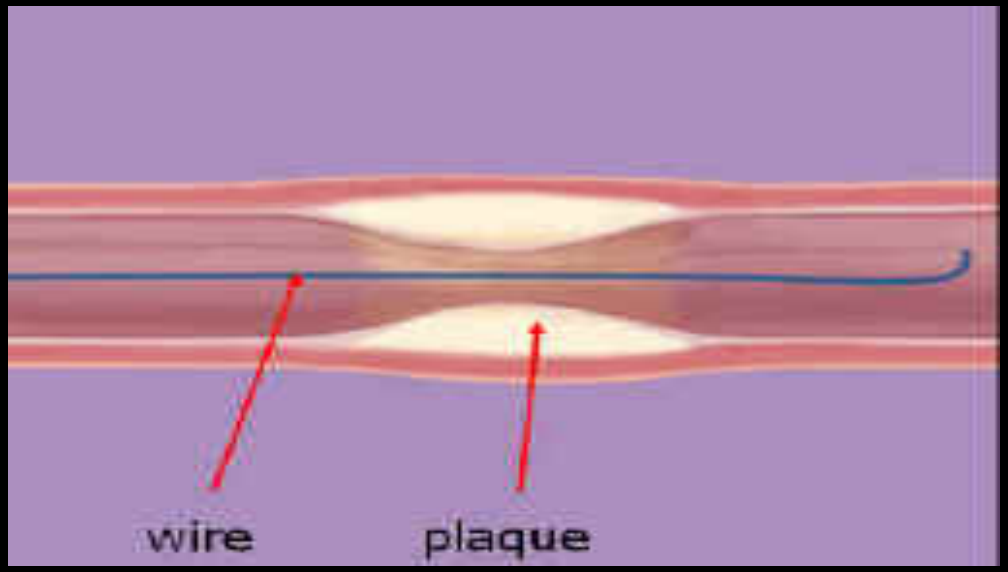
- Faster recovery than surgery
- Usually no hospital admission required (done as an outpatient)
- Local anesthesia used instead of general anesthesia
- Safe and effective

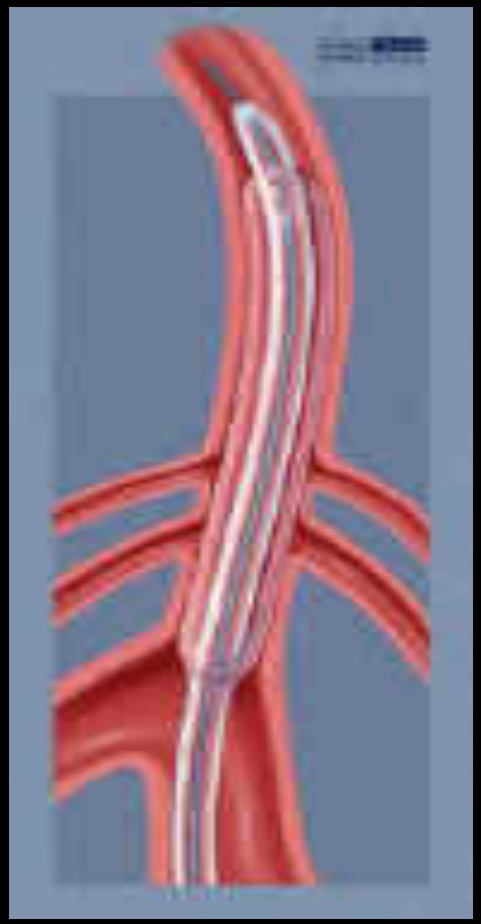
Angioplasty

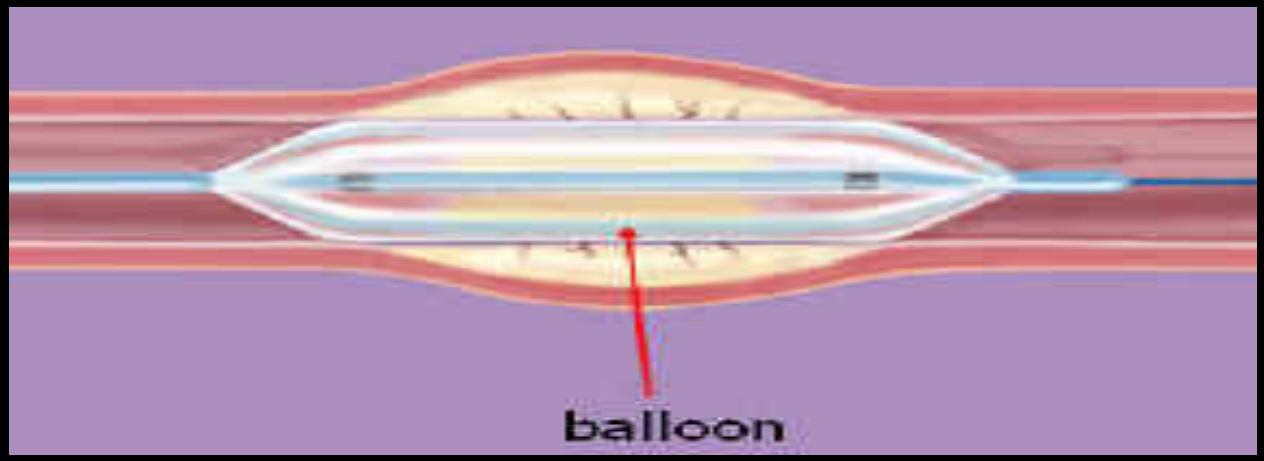
فتح الشرايين

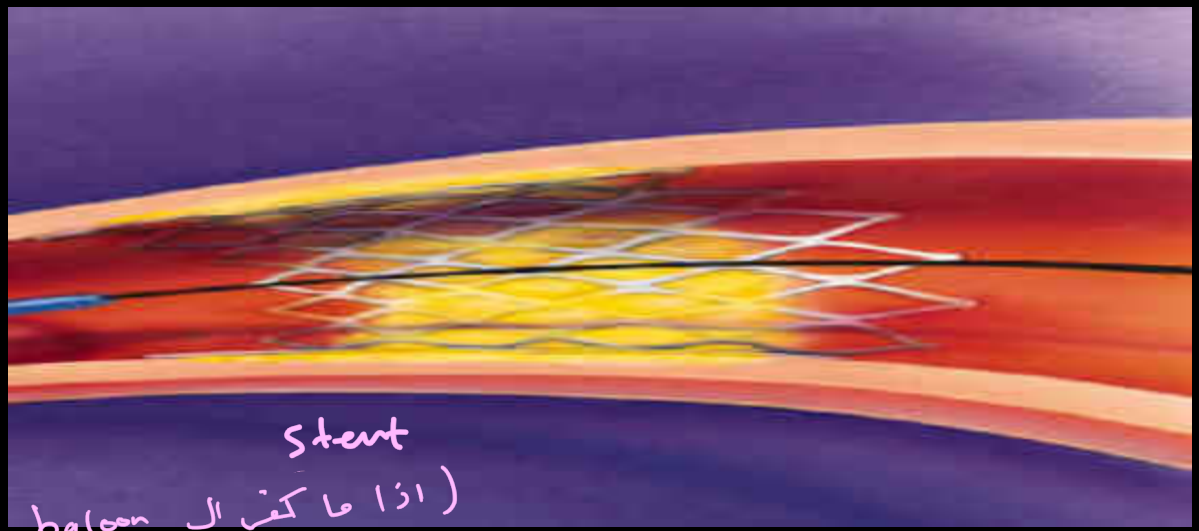
اصلاح توسيع

- **Angioplasty** (dilatation of a blood vessel with a balloon)
- Narrowing of vessels occurs commonly as a result of atherosclerosis

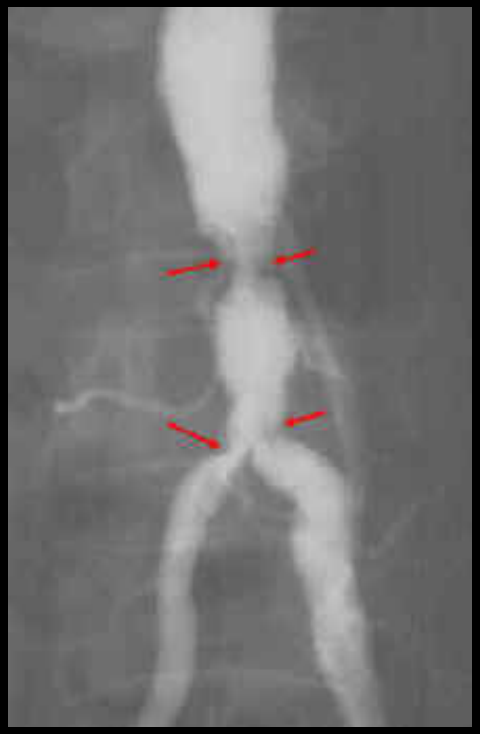

wire
plaque



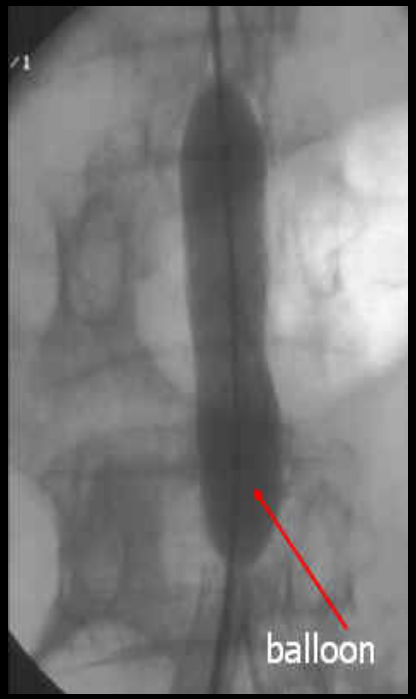


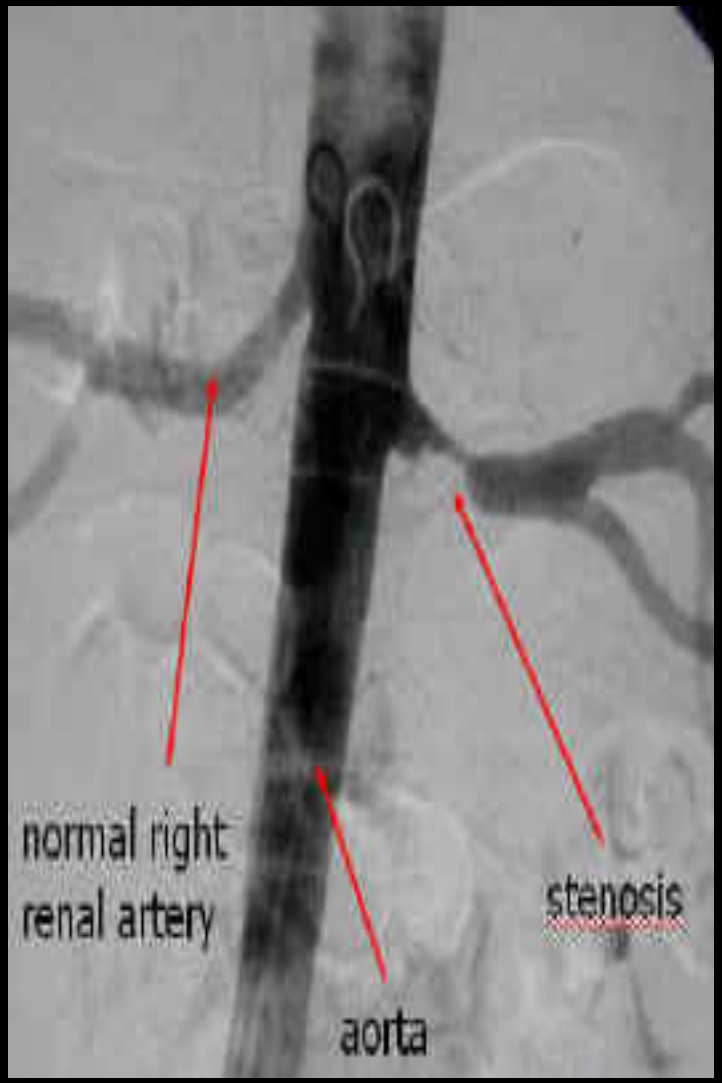


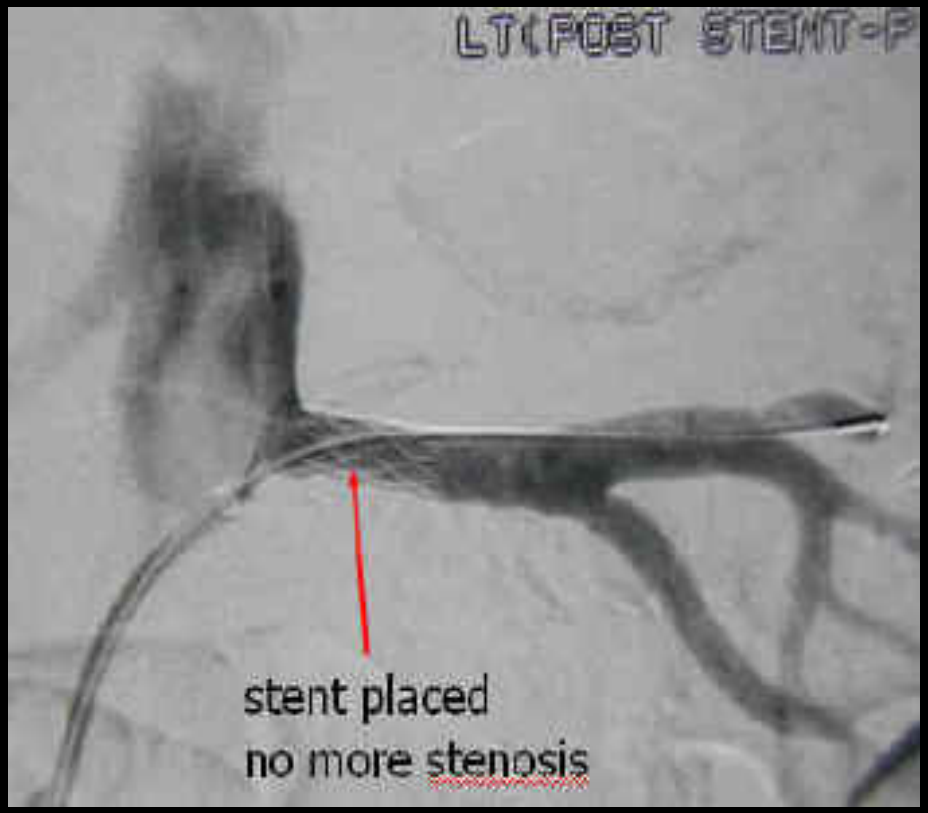
baloon اذا ما كفى ال
(stent بحط




balloons


balloon


normal right
renal artery
aorta
stenosis


LT(POST STENT-P
stent placed
no more stenosis

MRI PELVIS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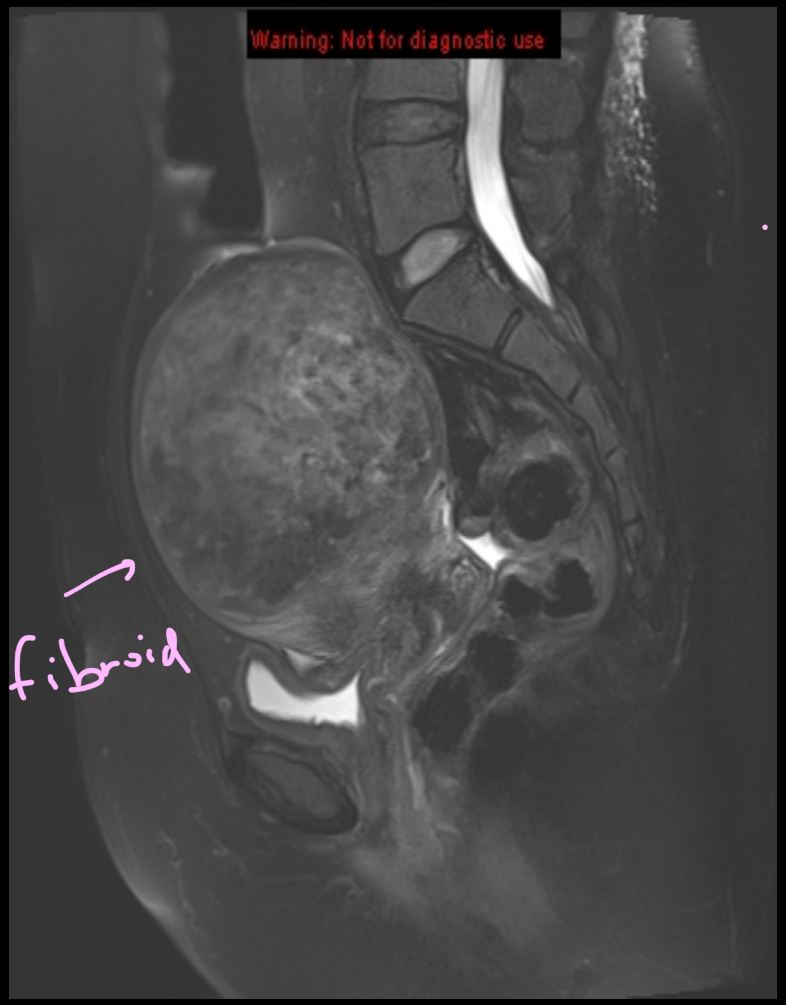
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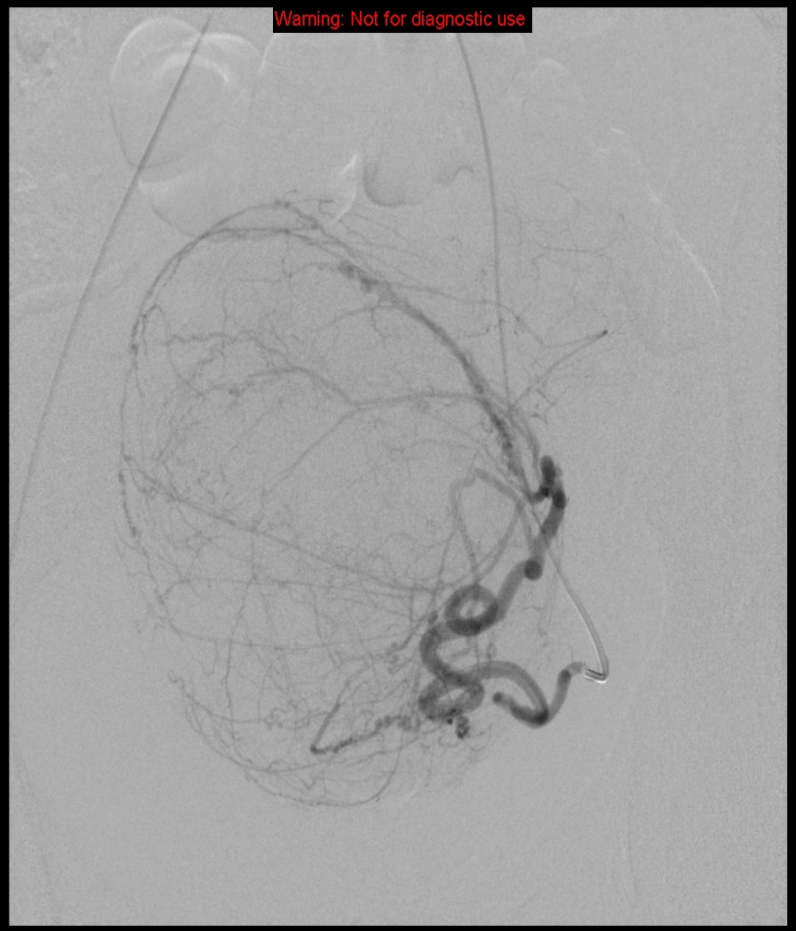
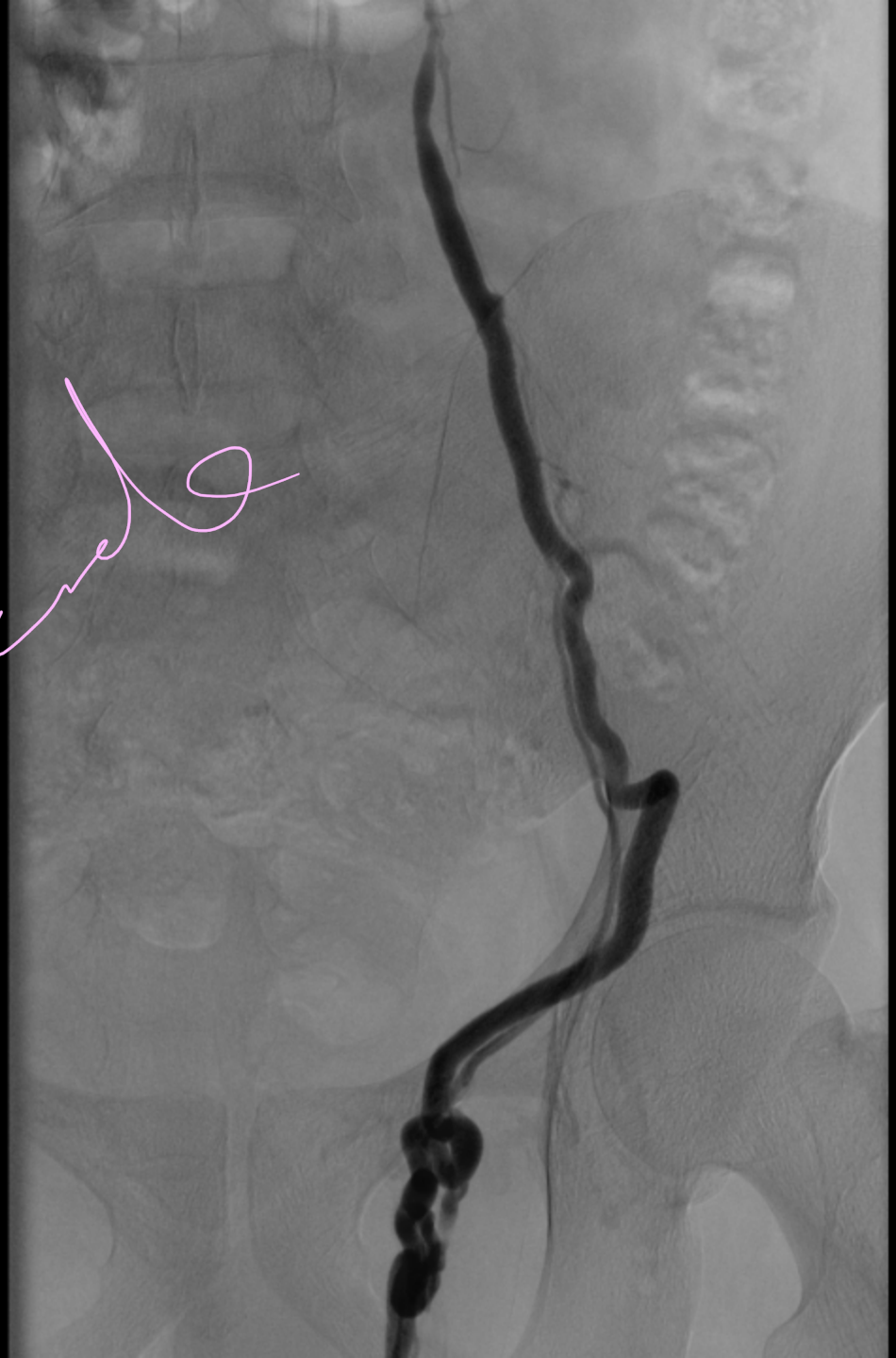
fibroid

FIBROID EMBOLIZATION




Filter IVC ?



ضط ال coils
وفسركهم

BILIARY DRAINAGE

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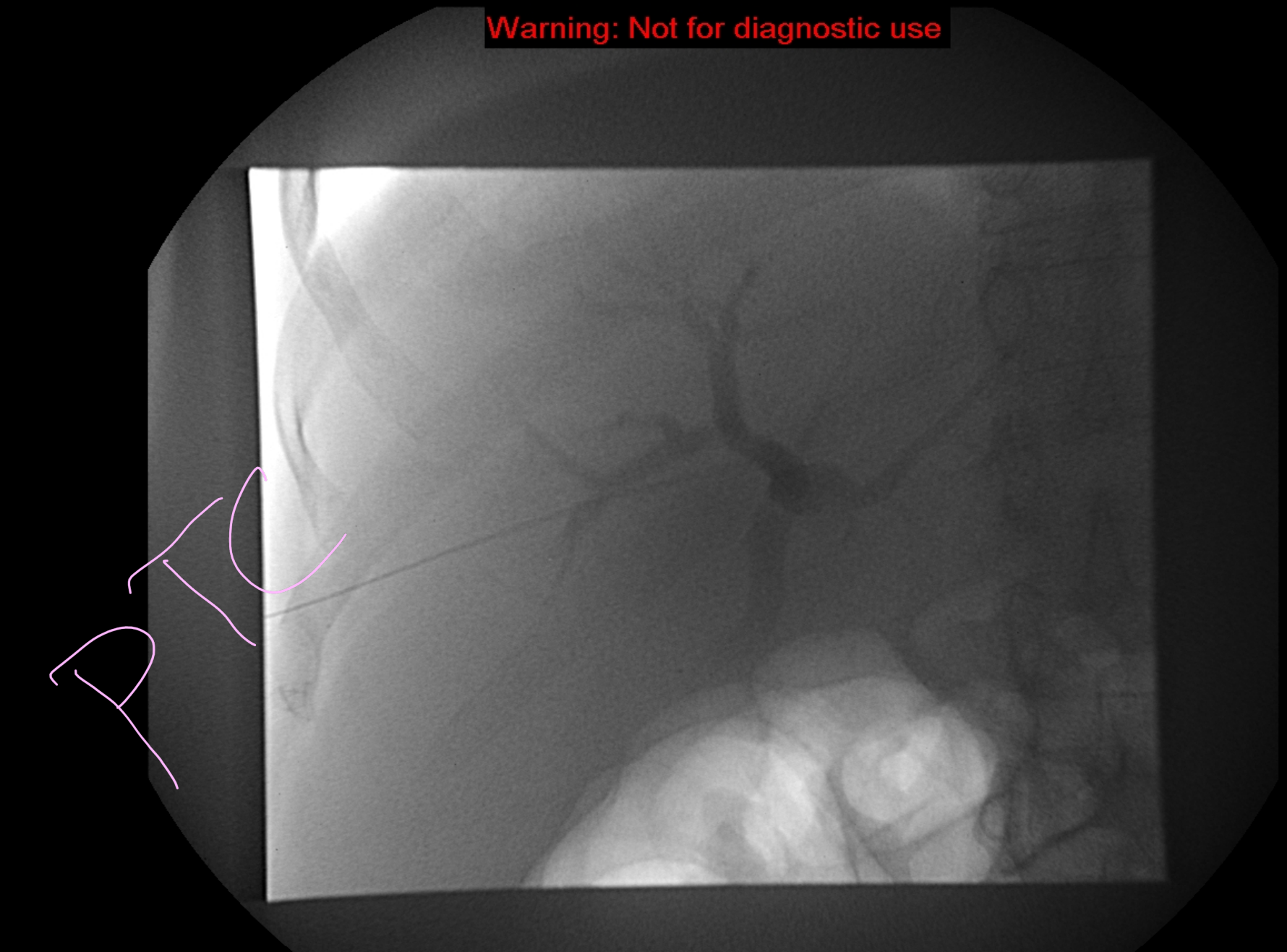
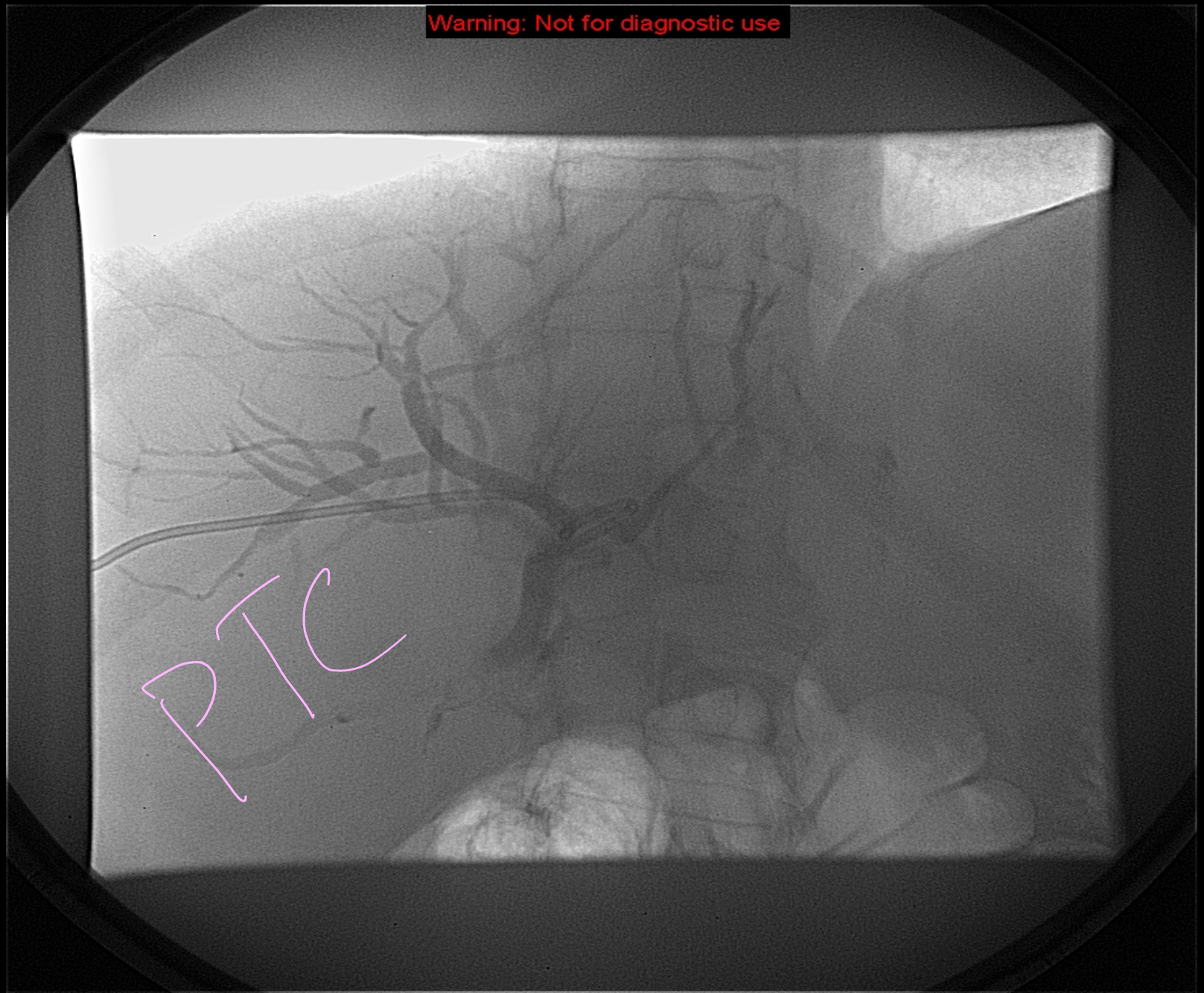
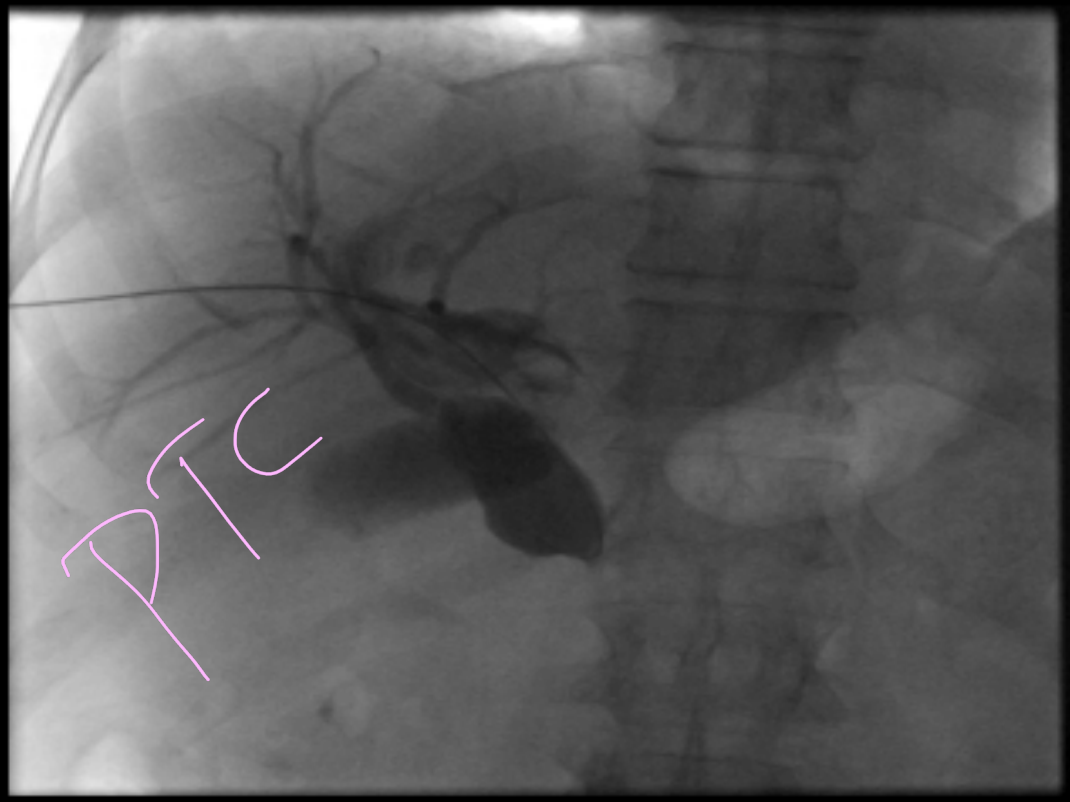


BILIARY DRAINAGE






PTC
+ drain


Stent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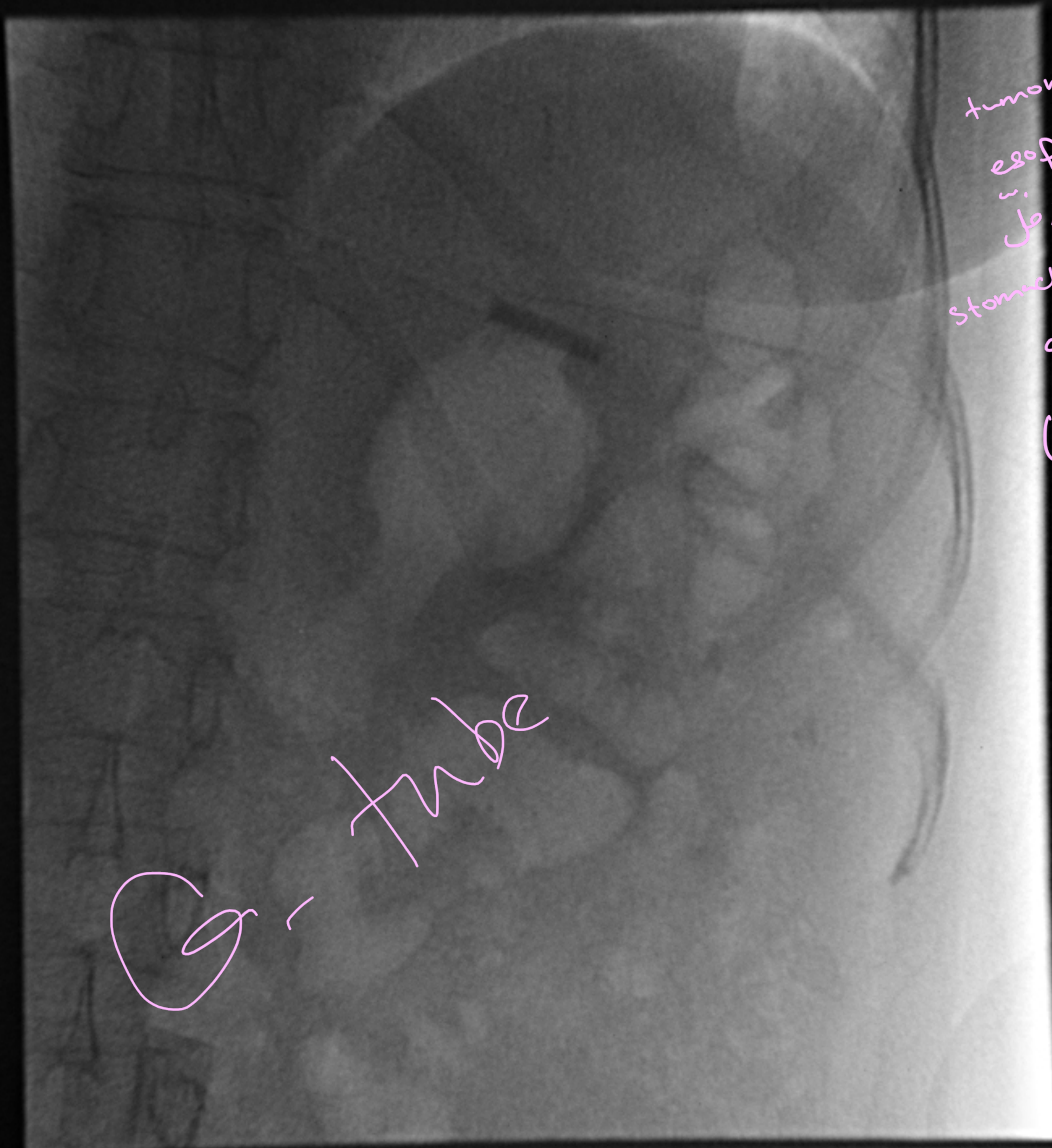
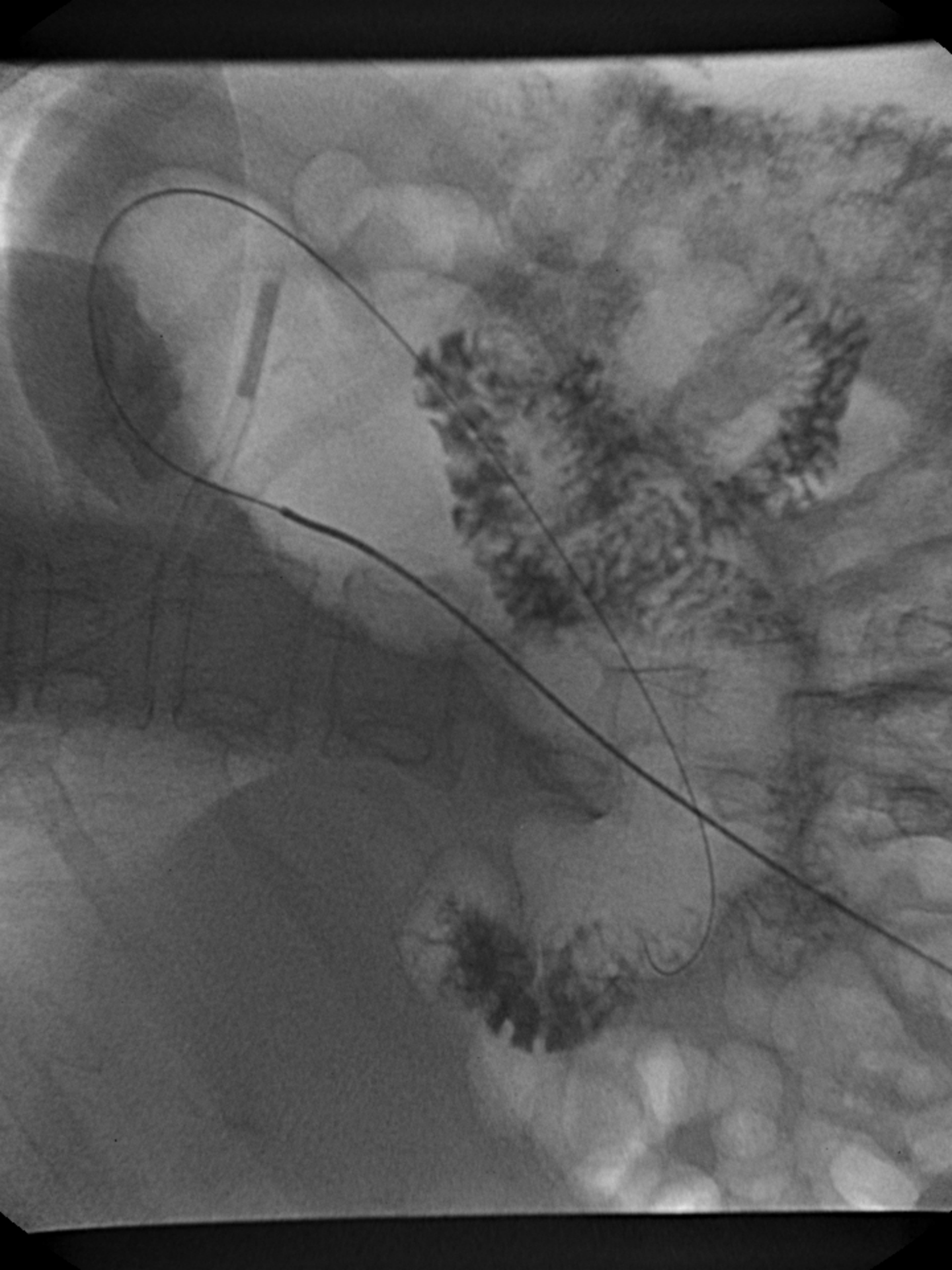
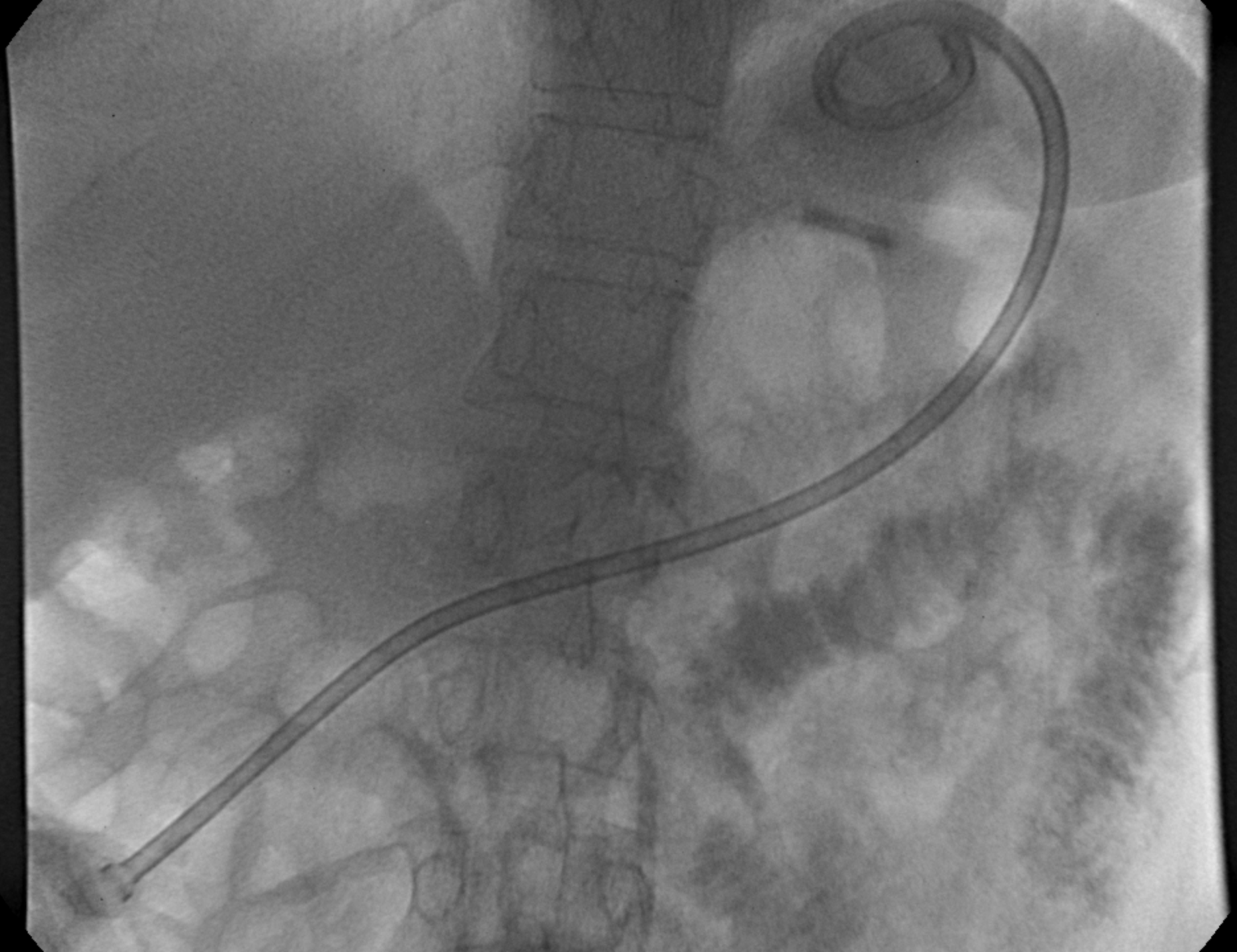
Stent

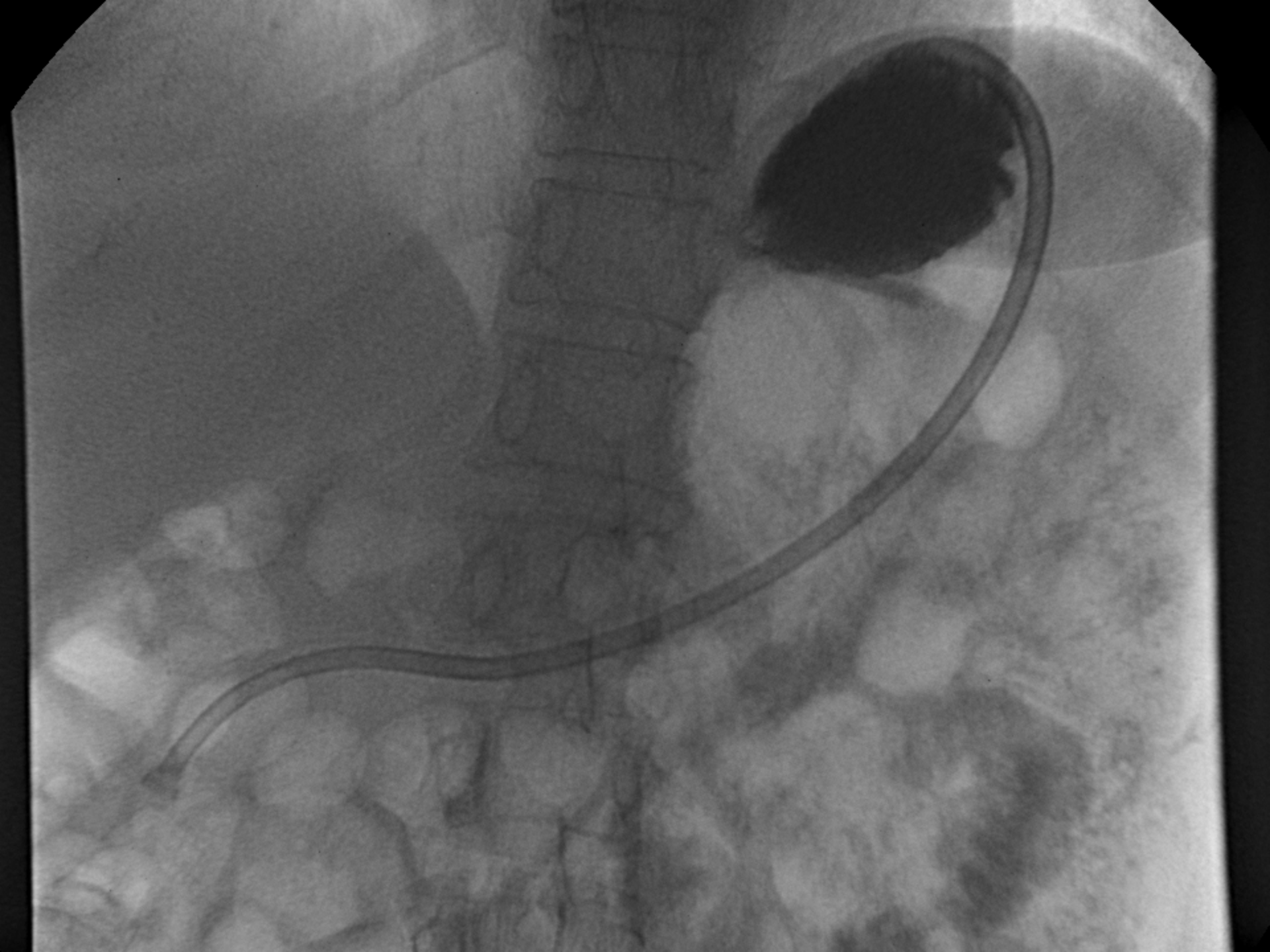


لما يكون في tumor بال esophagus وسكّر بنعمل tube بال stomach عشان نقدر ناكل (feeding tube)

G-tube = Gastric tube

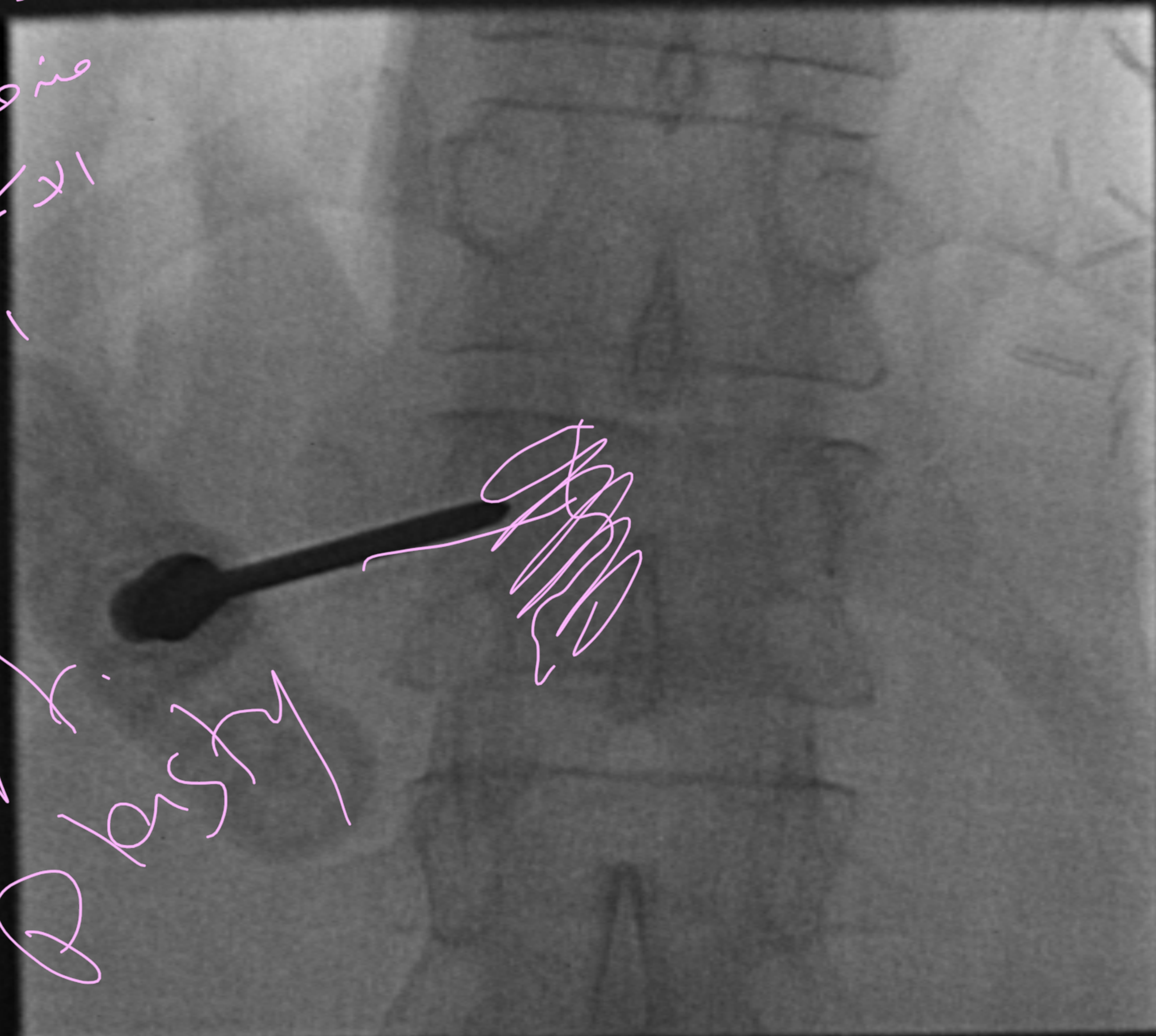


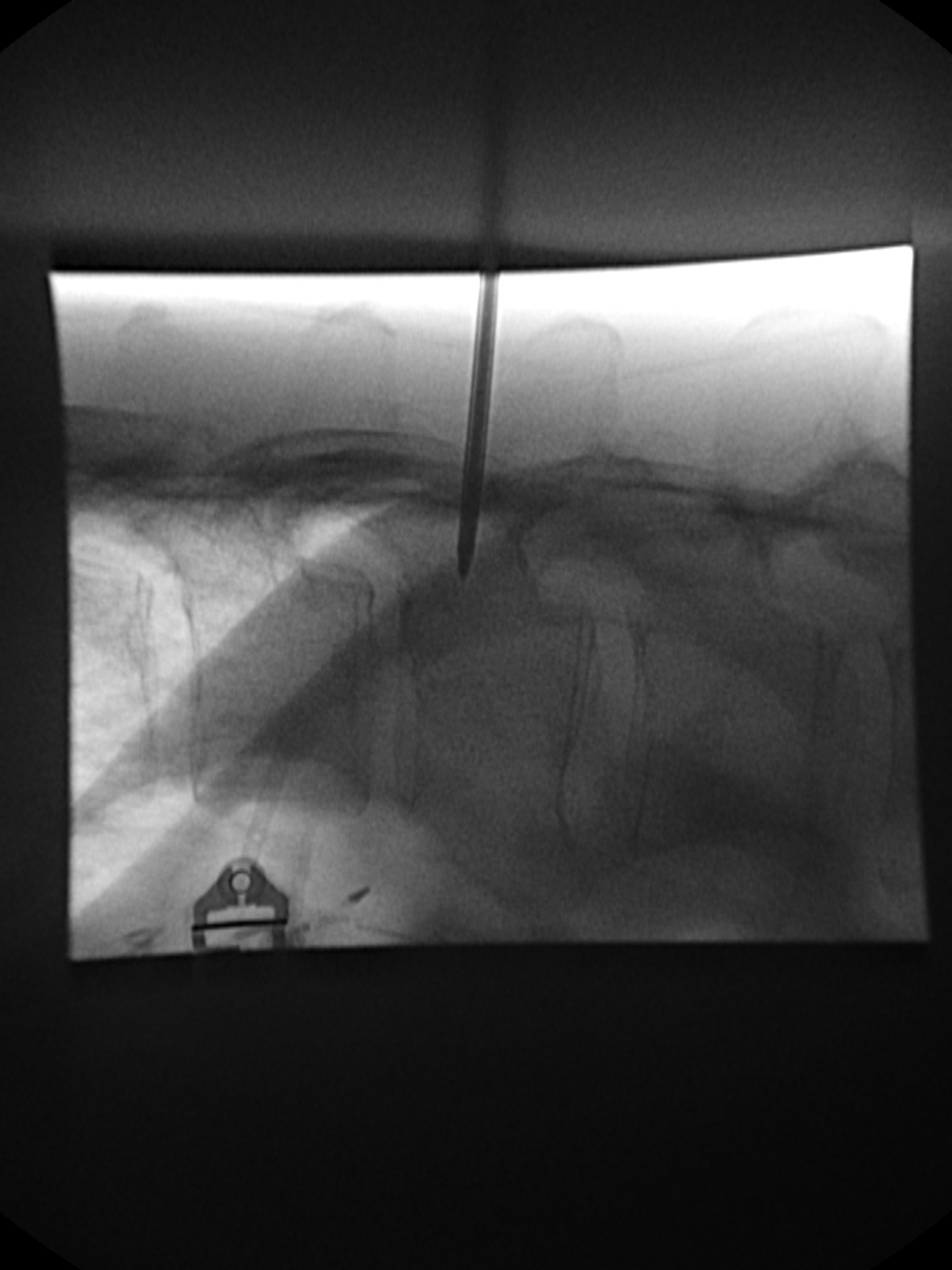


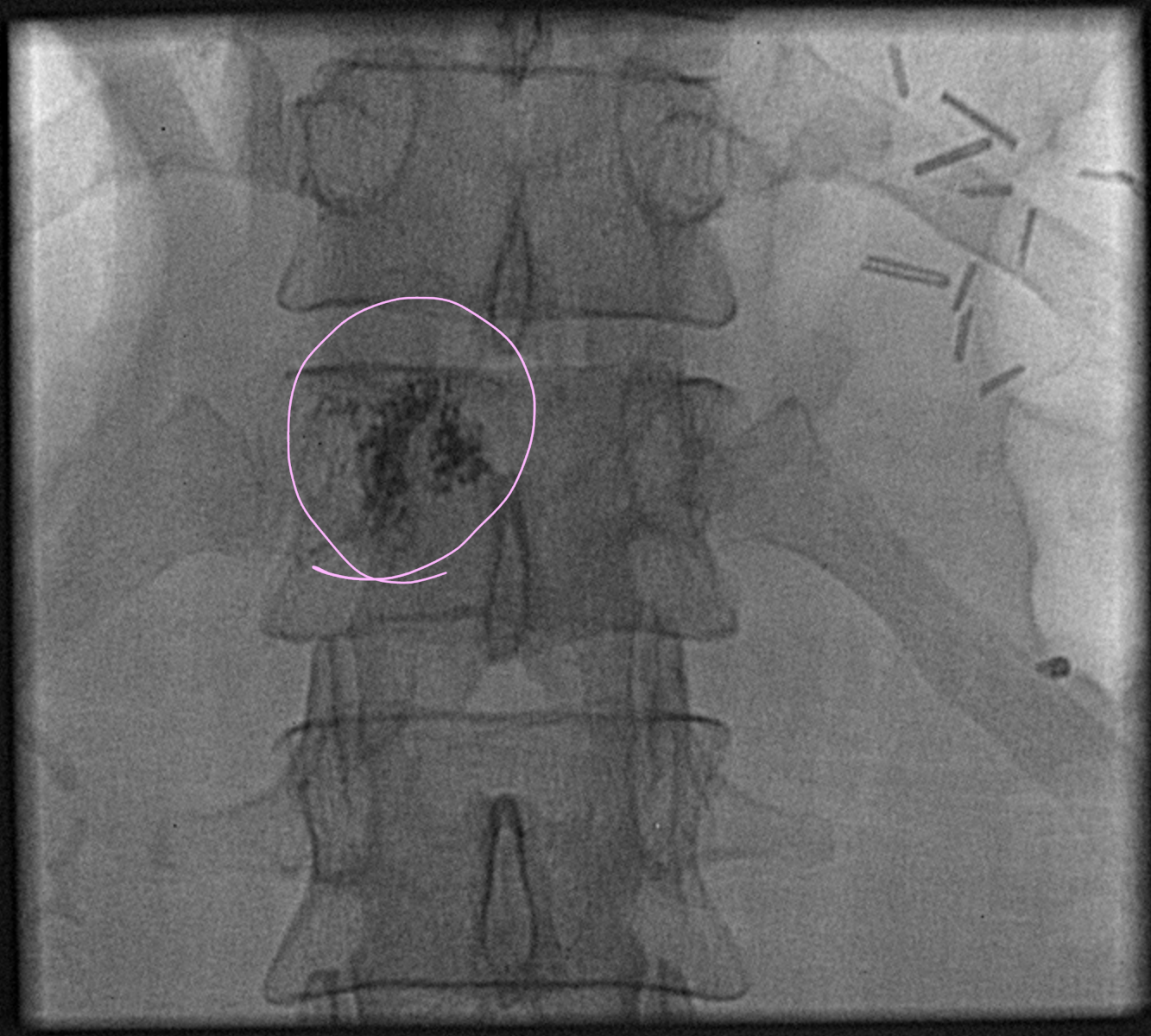


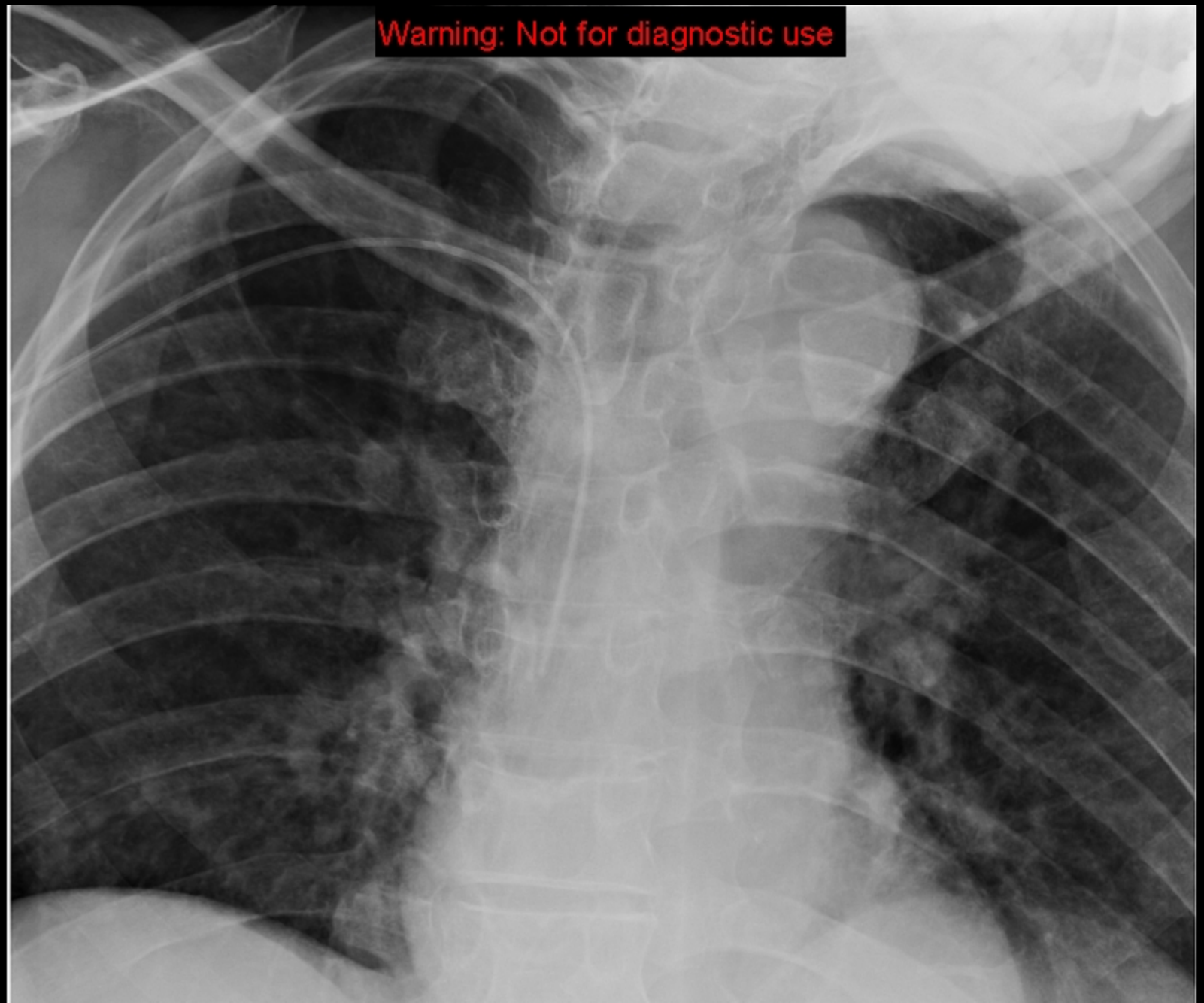
* الصور اللي بعد تكملة

بيكون فيه كسر
منعمل مادة زي
الاسمنت بيثبت
الكسر





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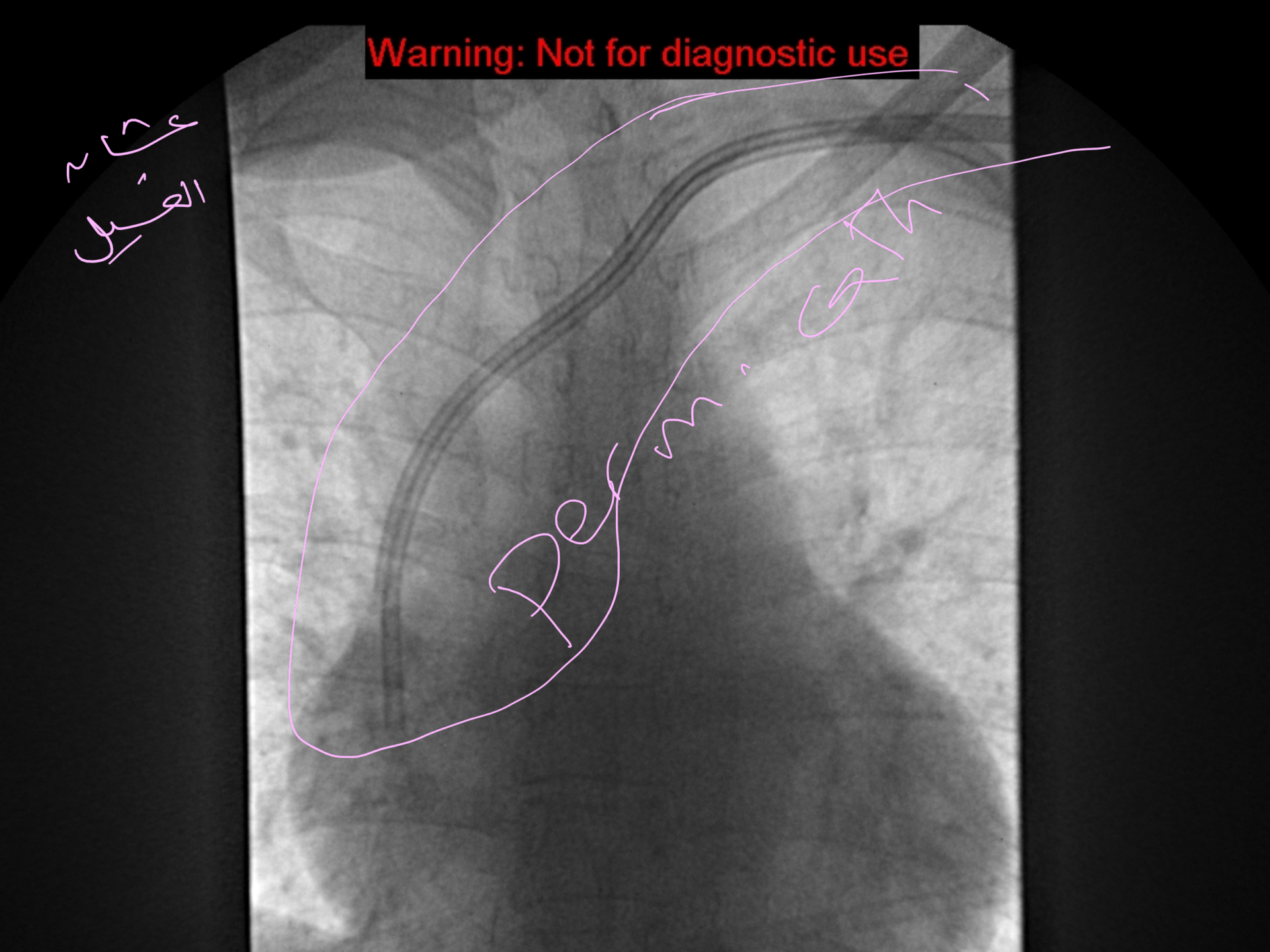
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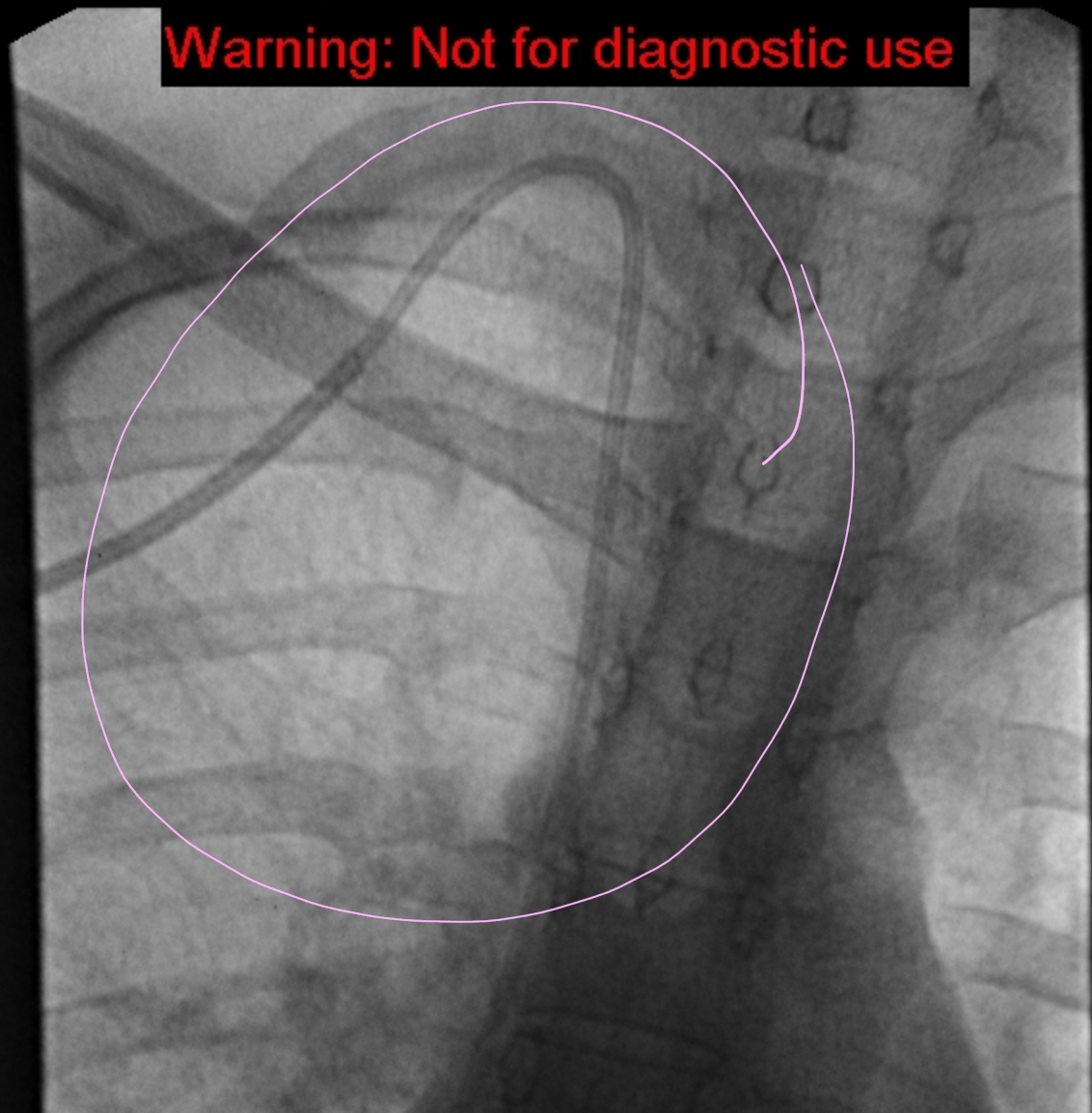
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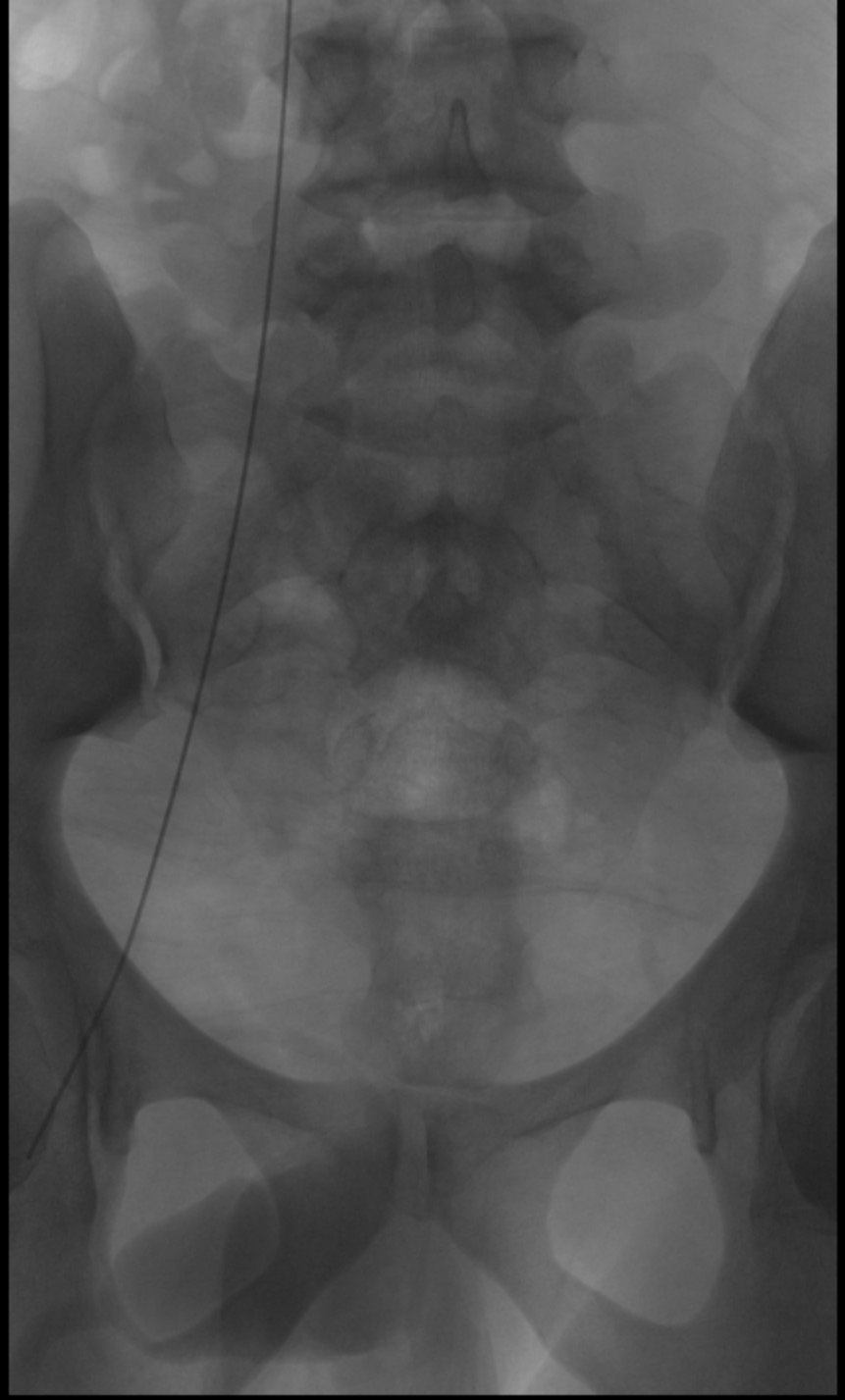
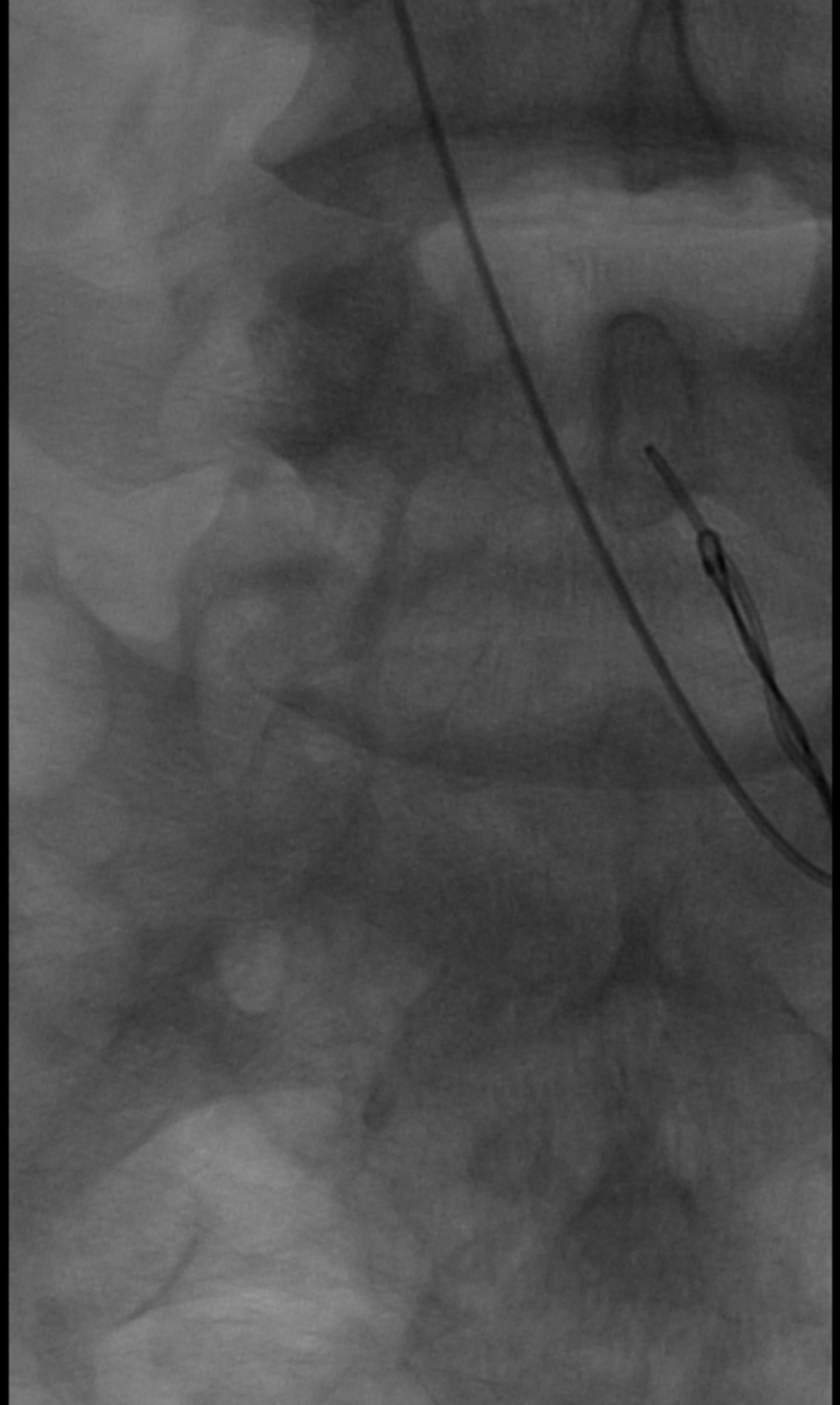
Snaring

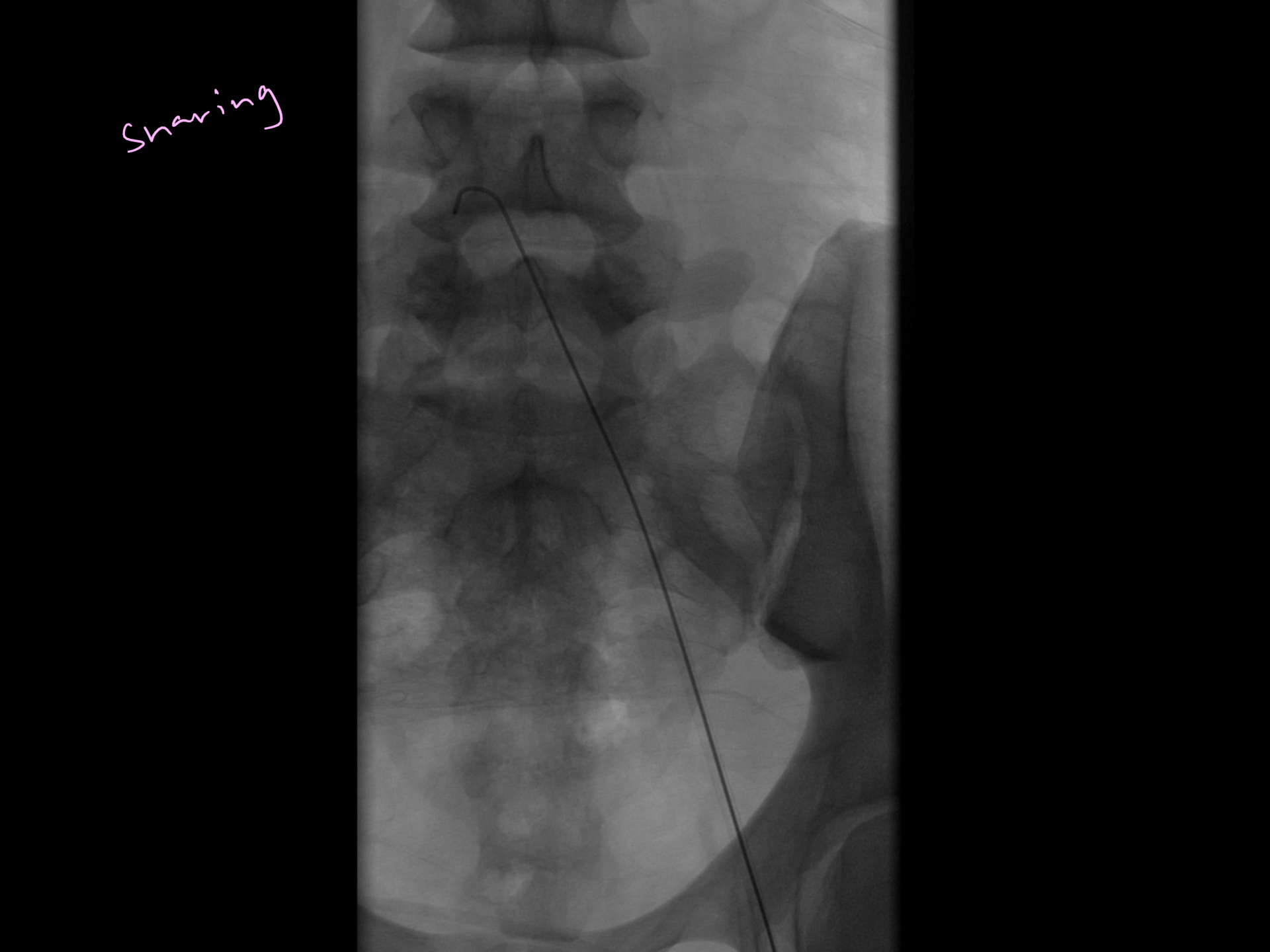
زي الملقط ، اذا به هم يطلعوا شي بعلوه

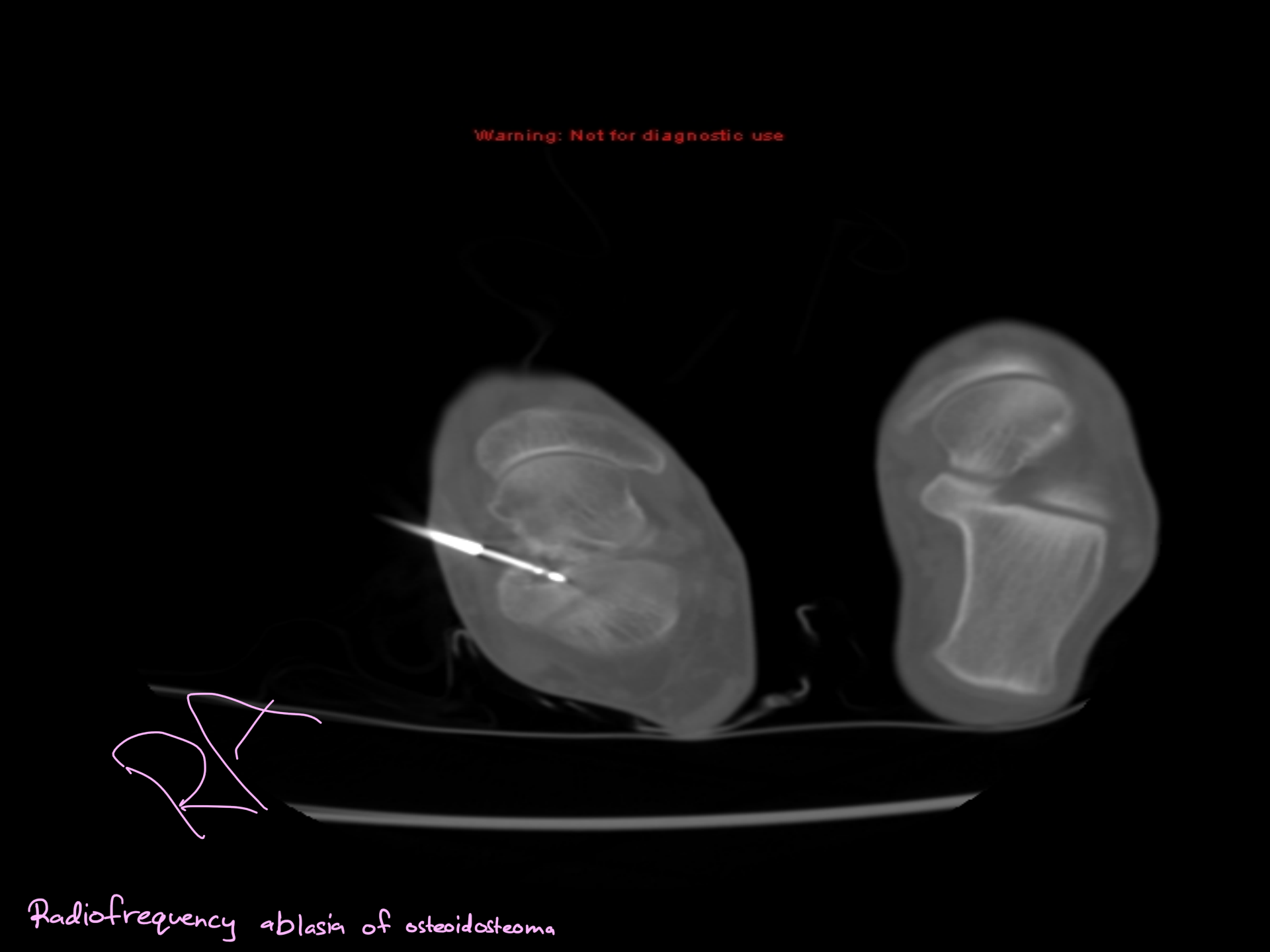
snaring



Snaring

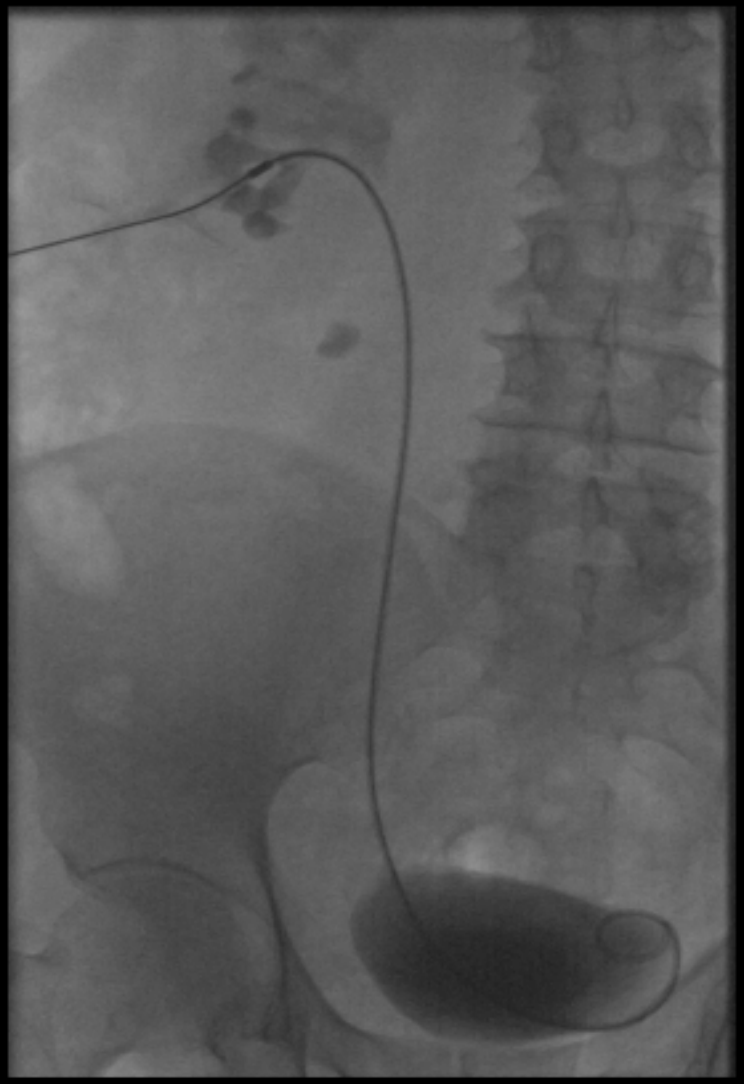


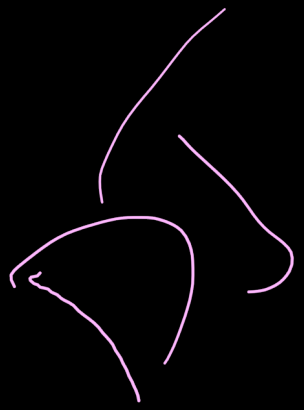

Sharing

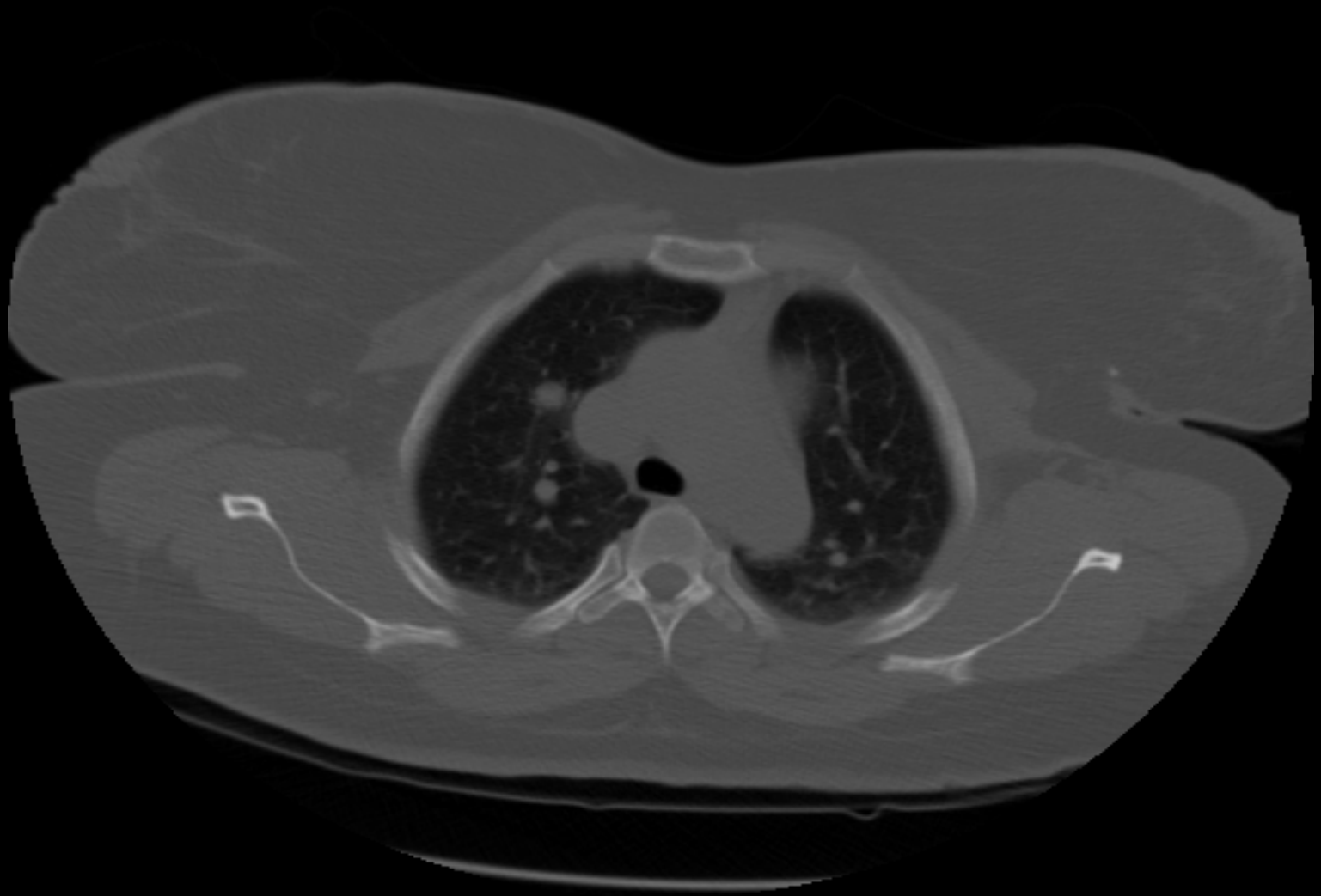


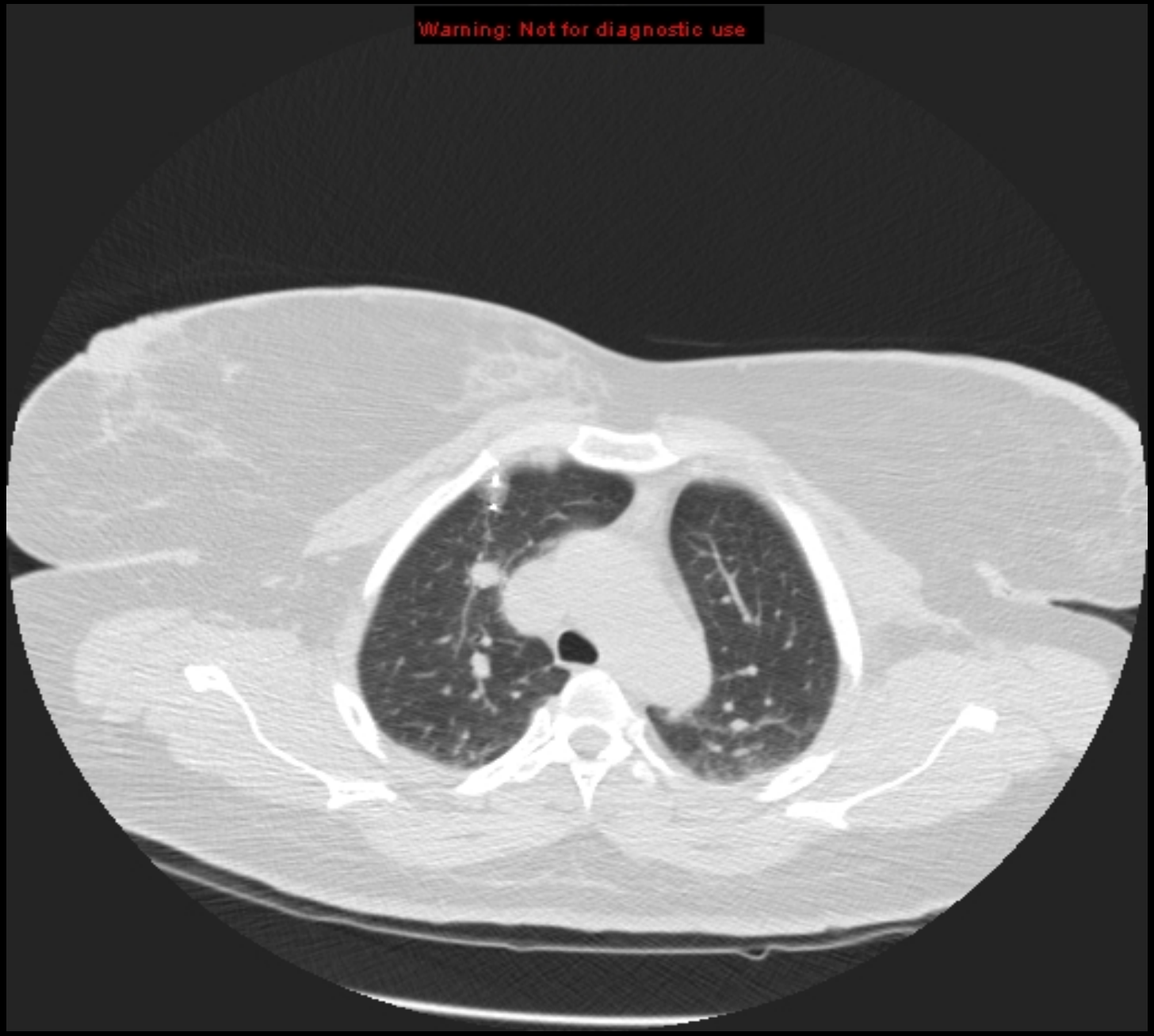
Radiofrequency ablasia of osteoidosteoma

DJ





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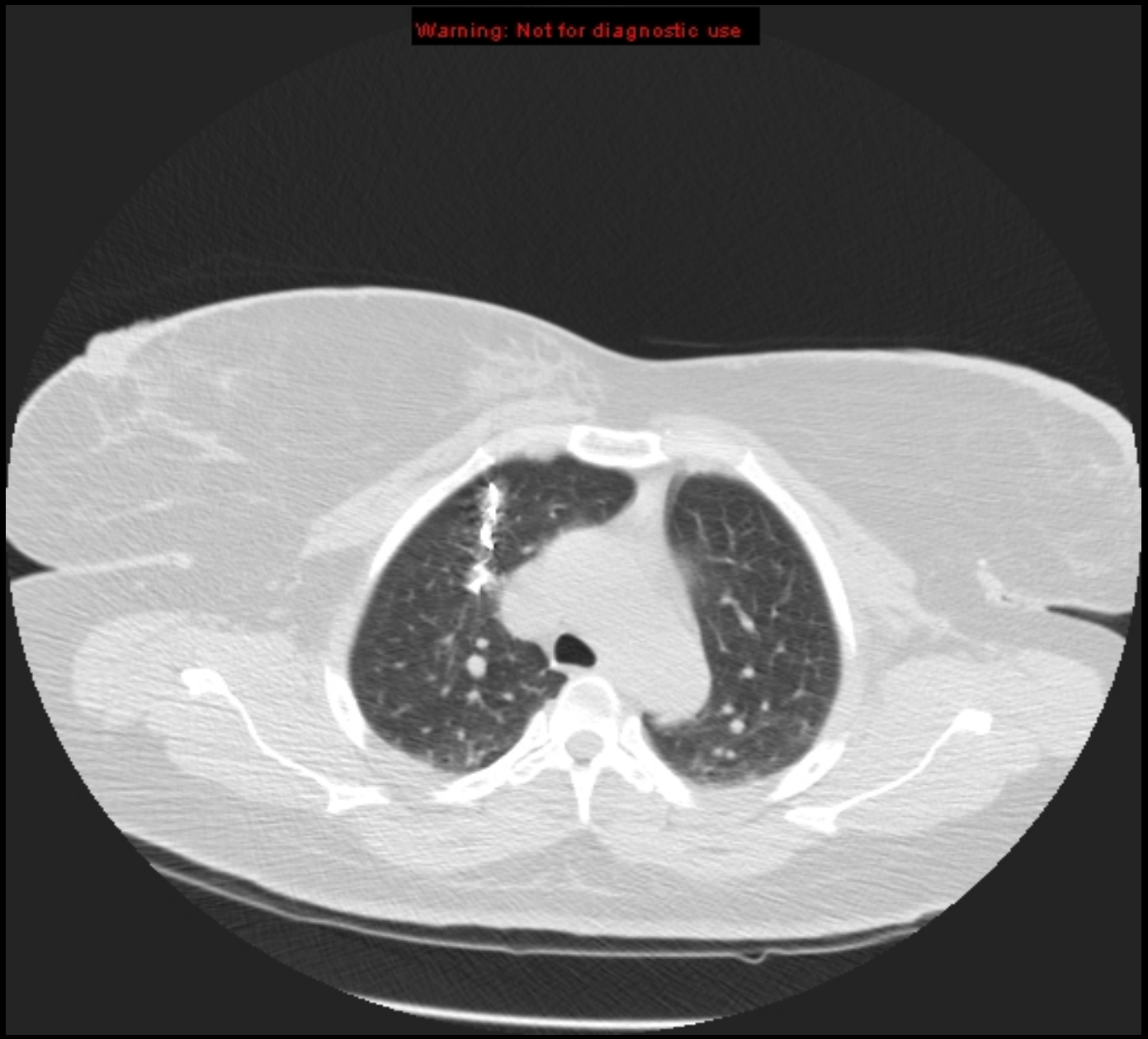
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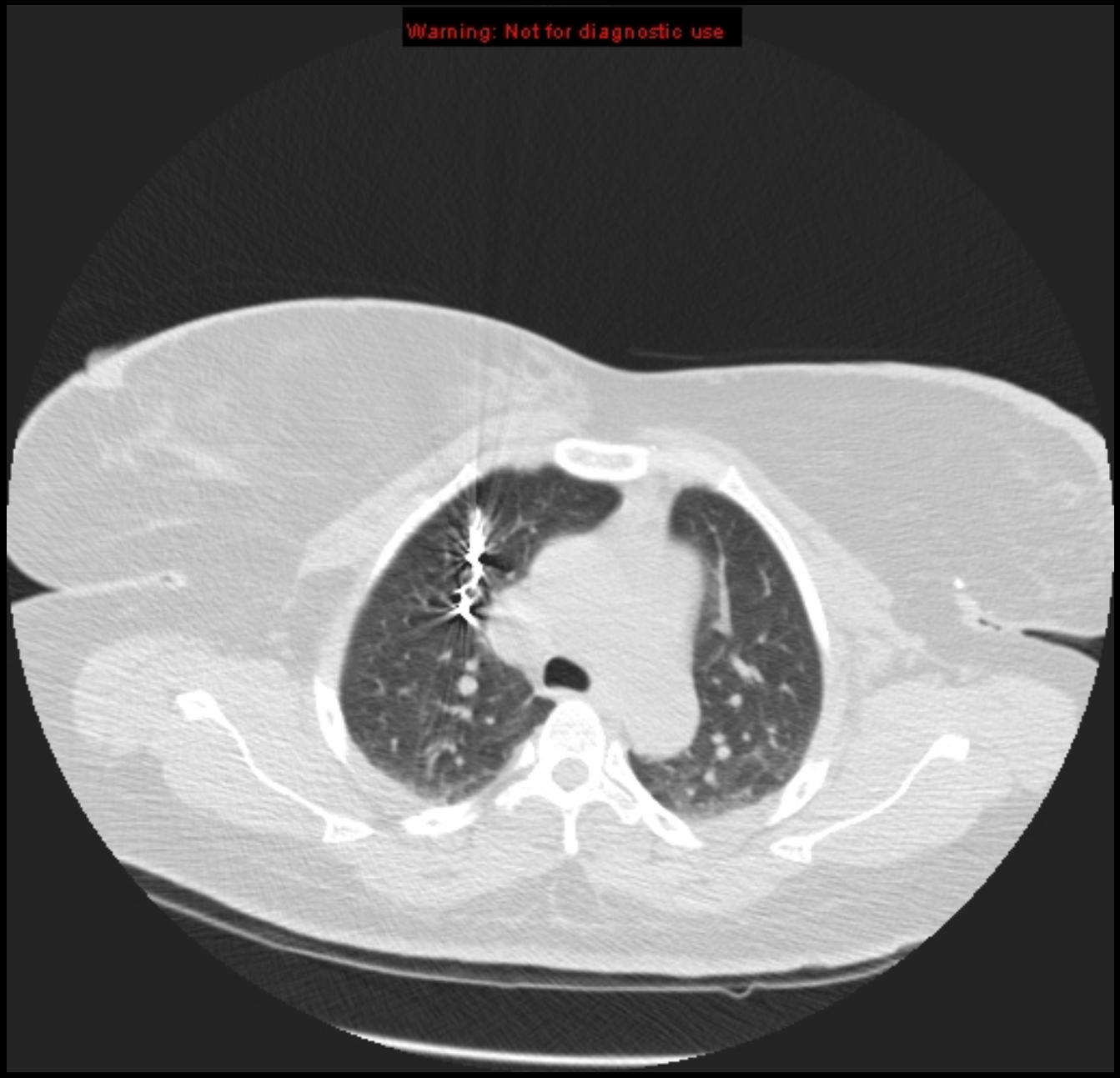
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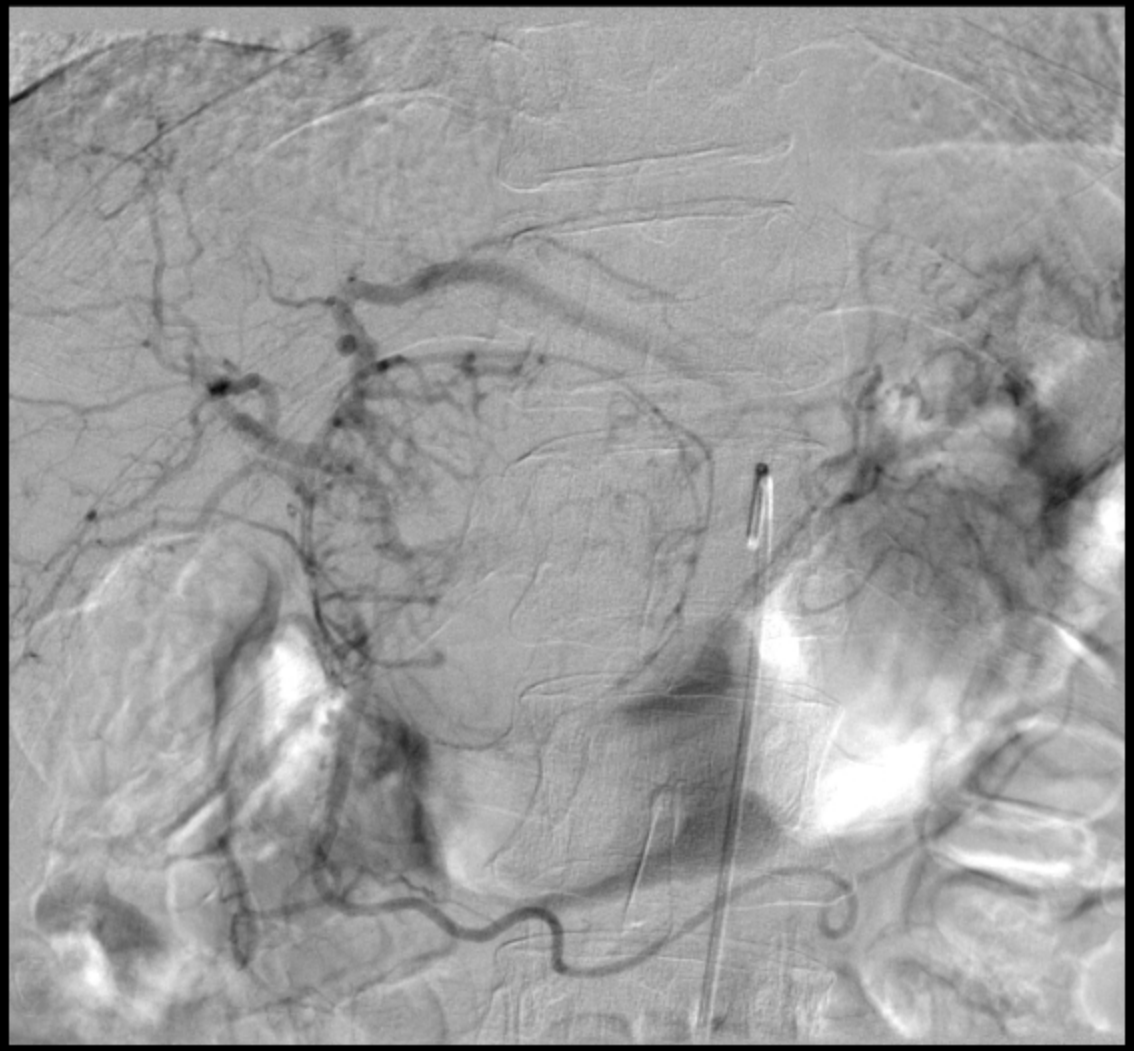
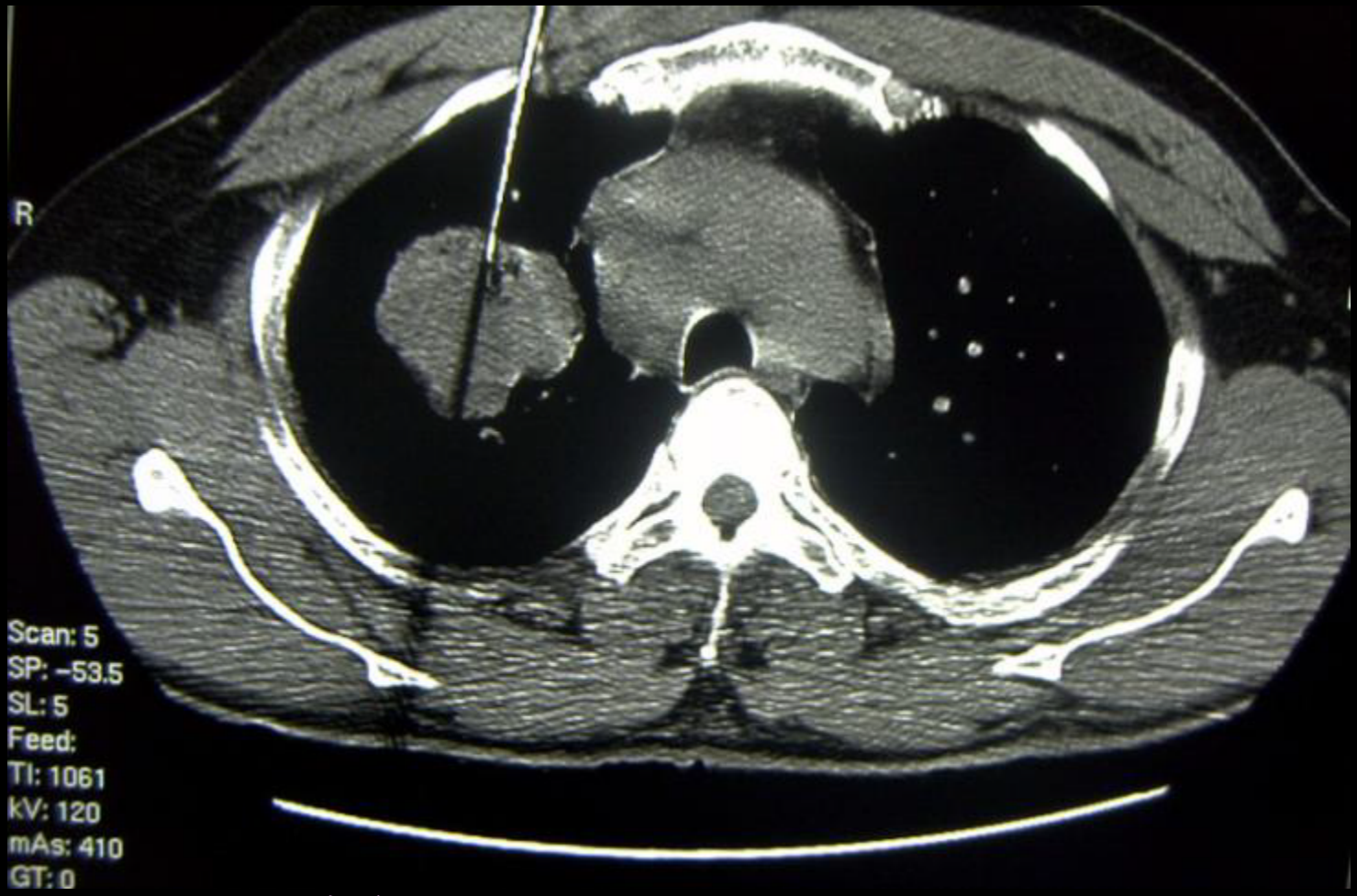
Embolisation

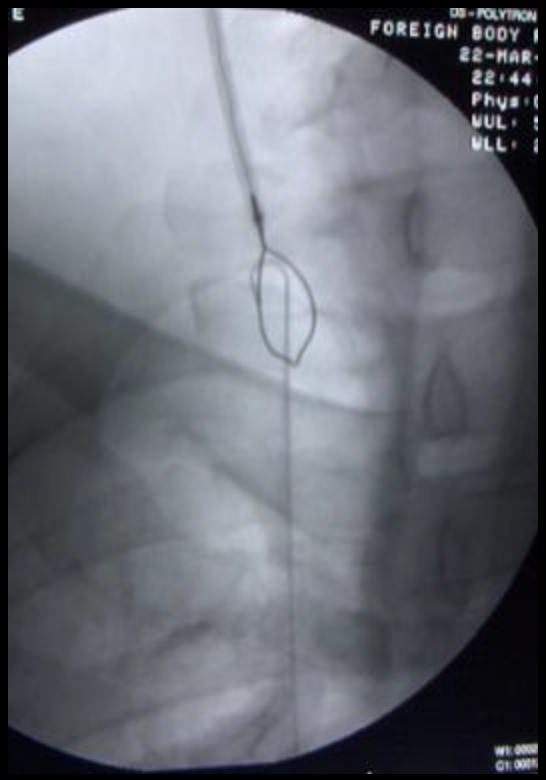
بعد ما عملنا
embolisation

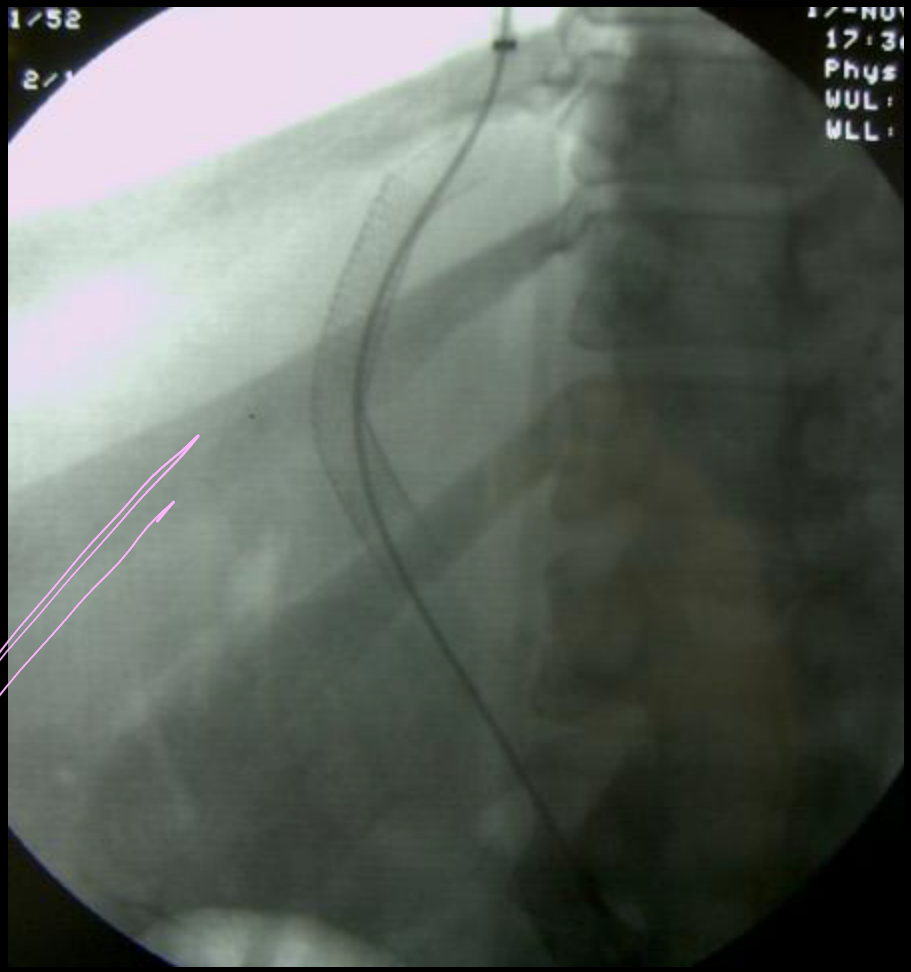




lung biopsy

snaring





TIPS

Food from mouth to Anus needs 24 hours , Drinks stay maximmally 4 hours

Abdomen and gastro - intestinal tract imaging

* GI from mouth to the anus is divided according to the radiological investigations into :.

1- Mouth to esophagus (food stays seconds)
2- Stomach + duodenum (food stays 4–6 hours)
3- Small bowel to the ileocecal valve (8-10 hours) → Absorption of nutrients
4- large bowel to the rectum (10-12 hours) → Absorption of water

* أهمية موضوع إنه أعرف كم بتقعد الوجبة في كل مكان إنه الـ Contrast اللي بستخدمها مايشربها المريض بدي أعرف متى رح توصل كل مكان

Give the contrast orally

1- Barium swallow → To study the esophagus → laterally & AP بصور المريض أثناء البلع
2- Barium meal → Stomach → بشرب المريض وبصوره و بنزل بالصورة على الـ stomach → بعلي المريض يلف كل الجهات ويصوره → بده ½ ساعة المريض وهو جوى
3- Barium follow through → small bowel → 2 hours (كل ½ ساعة بنصور)
4- Barium enema → Rectum

↳ Contrast given by rectal tube

* We assess th duration & motality

ممكن هذه العملية تطول إلى حد 4-5 أيام في الناس اللي عندهم مشاكل بنواله dysmotality أو ileus والعكس صحيح

IV Contrast :-

It's given with the CT & MRI → Gadolinium

↳ Non-ionic contrast media

* في مشكلتين أساسيات لـ Contrast :

1- Renal toxicity

2- Allergy

We will divide patients into 3 groups :-

1- Healthy , young :- Contrast will not affect them to clinically segnificant turm (يعني مثلاً الشخص عنده 3 - 4 مليون nephron، ممكن الـ Contrast تقتل 10 آلاف، فعلياً للإنسان يكفيه ربع هذا العدد عشان يخلي الـ Cr تاعه normal يعني في damage بس insegneficant)

* كمان عشان نقلل الـ damage بنقلل الـ Contrast وبنكثر الـ hydration قبل وبعد.

2- Renal failure :- We give Contrast & do CT-scan then we do hemodialysis

- Never to give gadolinium to a renal failure patient , Because it doesn't Come out with the dialysis → Nephrogenic systemic fibrosis (يبترسب بالـ joints : knee , elbo)

3- Border line :- We give gadolinium as it causes lower kidney damage

- If we need to do CT-scan → ↓ the dose of contrast & ↑ Hydration before & after

---

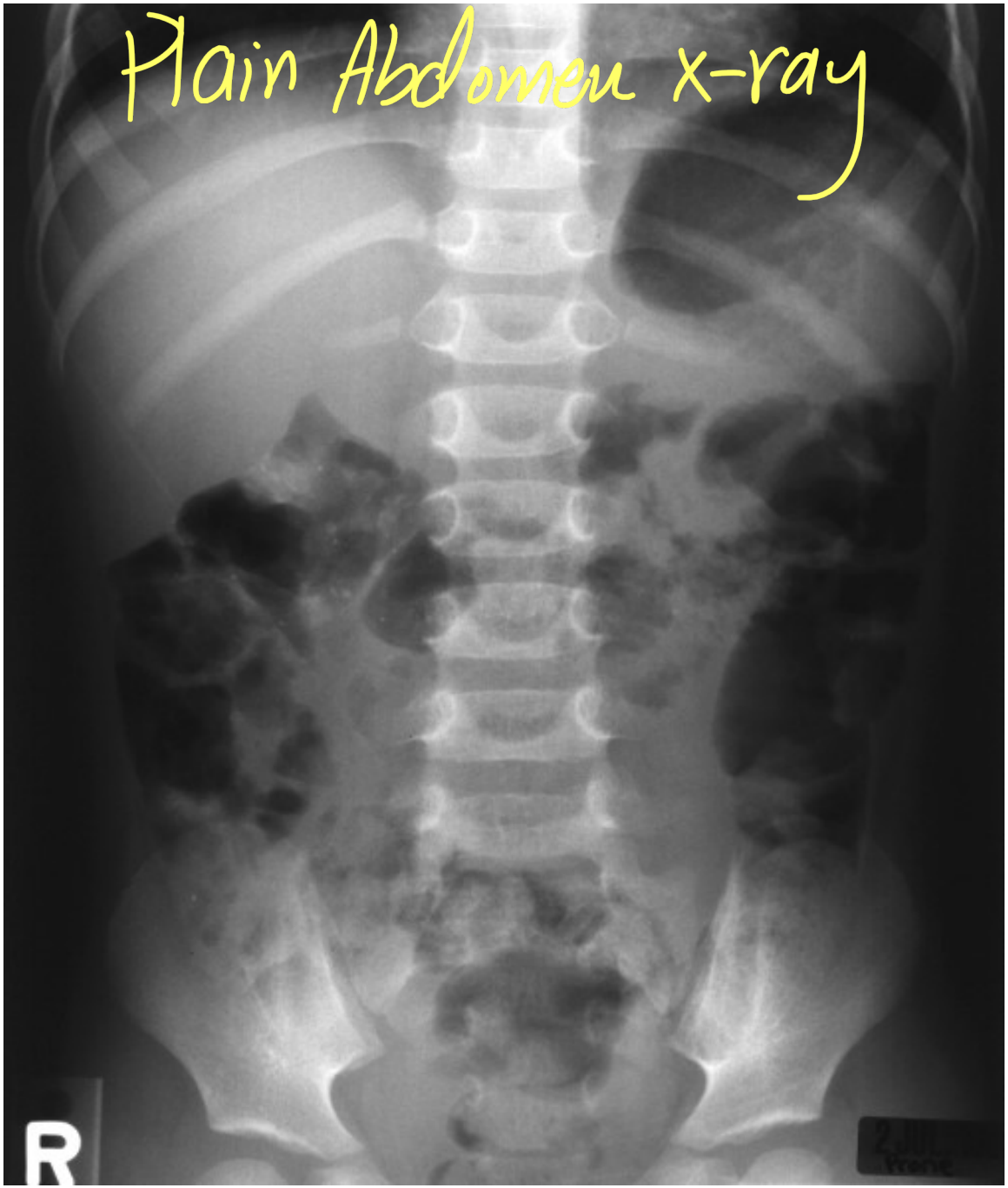
In allergy :- We give the patient before Contrast 3 doses of Cortizone & antihistamine

- When the patient comes to the appointment epinephrin & antiallergics are available- in case of anaphylactic shock ...

Abdomen and GIT investigation

- ***Plain abdomen films still retain as one of the most useful initial investigations.***
- ***The following structures should be checked :***

1. **Bowel gas pattern** * بشوف الأشياء اللي بتقدر نشوفها أو نتحسسها من خلال الـ Chest x-ray ؟
2. Radio-opaque stones or calcification → Radiation يعني بتبين بالـ — 85% of stones appear on X-ray, 15% appear only on CT scan
3. Extraluminal free gas — e.g. In perforation cases
4. Signs of intestinal obstruction :- Bowel lobes, air fluid levels
5. Skeletal abnormalities :- spine, hip ...


Plain Abdomen x-ray
R


RT
SUPINE

KUB

Kidney, ureter, bladder

semphysis pubis   * لازم يكون ال
مبين

The only side effect → إذا كان فيه Perforation وطلعت على الـ peritonium بتعمل peritonitis

Contrast medium in G.I.T studies

→ obstruction مشكلته إنه كتير ثقيل ممكن يزيد المشكلة في الـ

- **<u>Barium sulfate</u>:** is the most commonly used in barium studies of the GIT. (It's powder) طعمه زاكي .

- **<u>Gastrografin:</u> is used in:** → أغلى , its image quality is low (باهت) , طعمه مر (بعزي) → بتكون نفس الـ Consistency of water

  - suspected bowel perforation
  - post-operative for leakage.
  - meconium ileus (in neonates).

Gastrografin is contra-indicated in Barium swallow and meal if the patient is at risk of aspiration such as in infants, because gastrografin can induce pulmonary edema and chemical pneumonitis. Pulmonary edema is worse than peritonitis

- **<u>Non ionic contrast medium</u>** (omnipaque) is used in barium swallow studies in infants. ↳ The IV contrast of the CT , Very good image quality , طعمه مش مقبول , water soluble , تكلفته عالية

يعني لو واحد عنده risk of aspiration و suspected bowel obstruction بنعطيه Barium meal

Gastro-intestinal tract investigations

BARIUM SWALLOW

- Is the examination of the esophagus with contrast medium .
- The contrast used is barium sulfate for most examination .
- Non ionic contrast media is used in infants and small children .

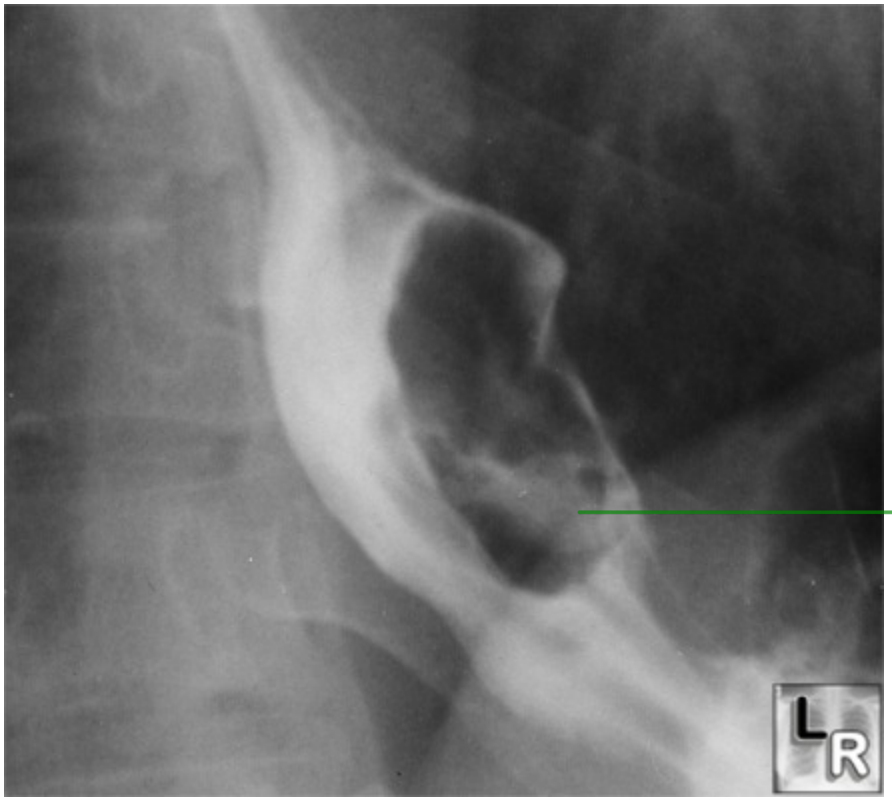
Barium swallow / 2

Indication of Ba. swallow:

1- Symptoms of gastro-esophageal reflux

2- dysphagia which could be related to :

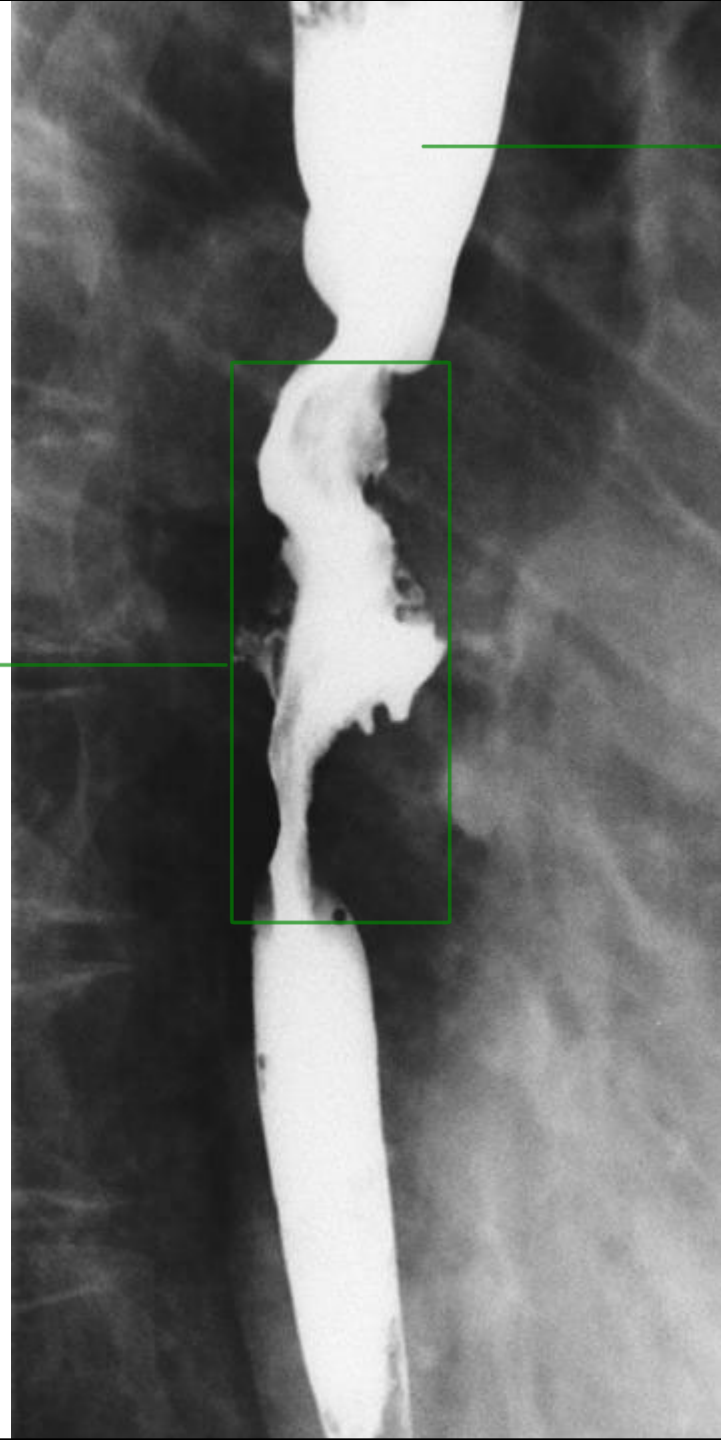
- Esophageal stricture
- Esophageal tumor
- Suspected achalasisa
- Vascular abnormalities
- Esophageal web



leomyoma

* Lateral view to the esophagus

AP view of barium swallow



Proximal dilatation

منطقة ال Tumor

احنا ما بنشوف ال Tumor نفسه ، بنشوف ال effect تاعه .

Achalesia

↓

Failing of LES to relax

→ Air . fluid levels

علاجه ← بفتحوا الـ sphincter بيرجعوا لـ relaxation

BARIUM MEAL

- Is the examination of the stomach and duodenum with barium sulfate .
- Double contrast is obtained by introduction of gas into the stomach using effervescent powders and barium.
- The gastro-esophageal junction is observed for reflux .

Indication :

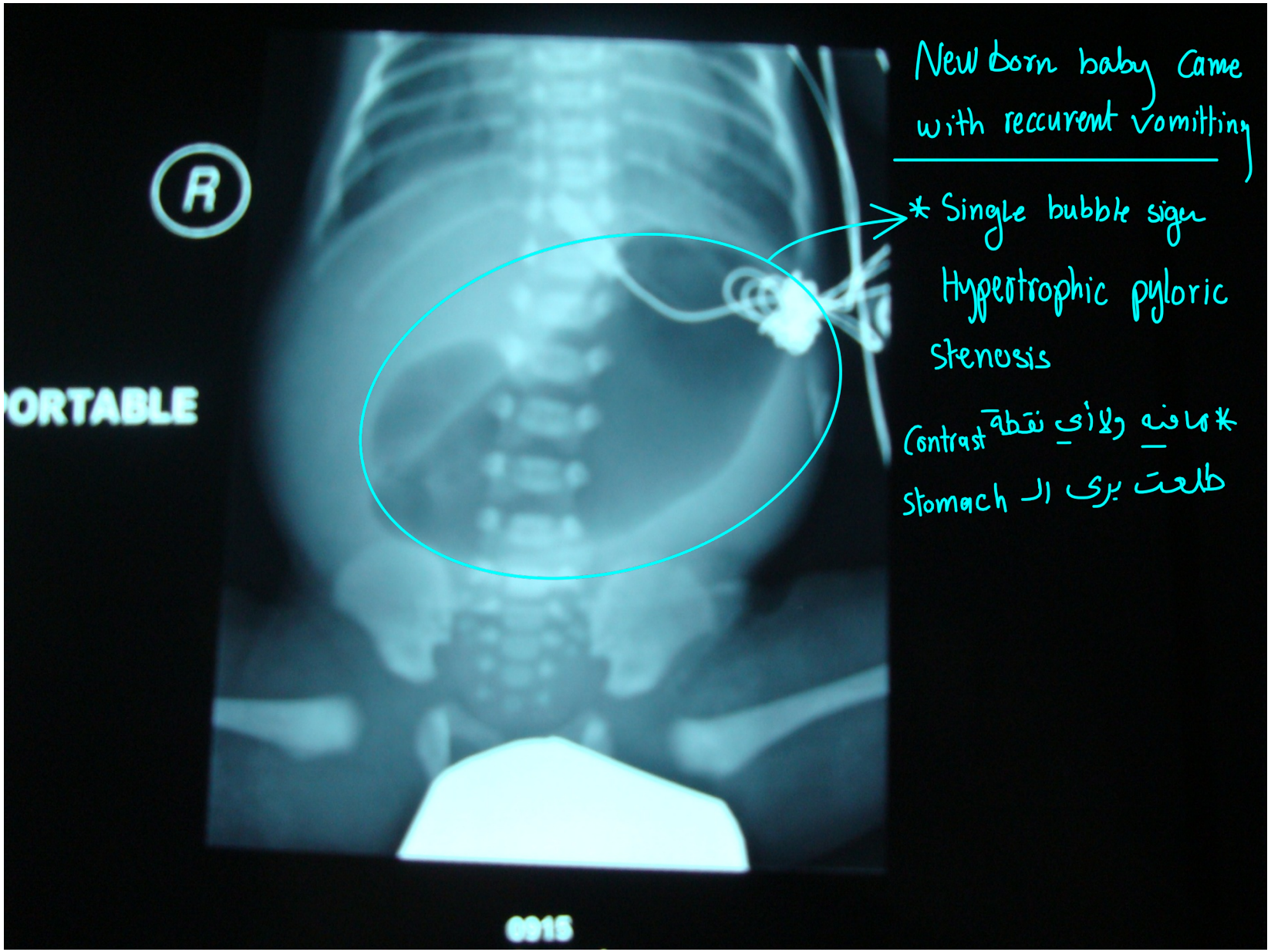
- ❖Gastro esophageal reflux
- ❖Gastric or duodenal ulcer
- ❖Hiatus hernia
- ❖Suspected gastric tumor

*Low sensitivity & specifity

وتمتص الـ contrast بين الـ ruges وتجمعت

الأصل إنها تكون Homogenous

*لازم نشرب المريض كمية بسيطة واحنا بنصور ، إذا شربناه كمية كبيرة بسرعة بيمتص كل شيء

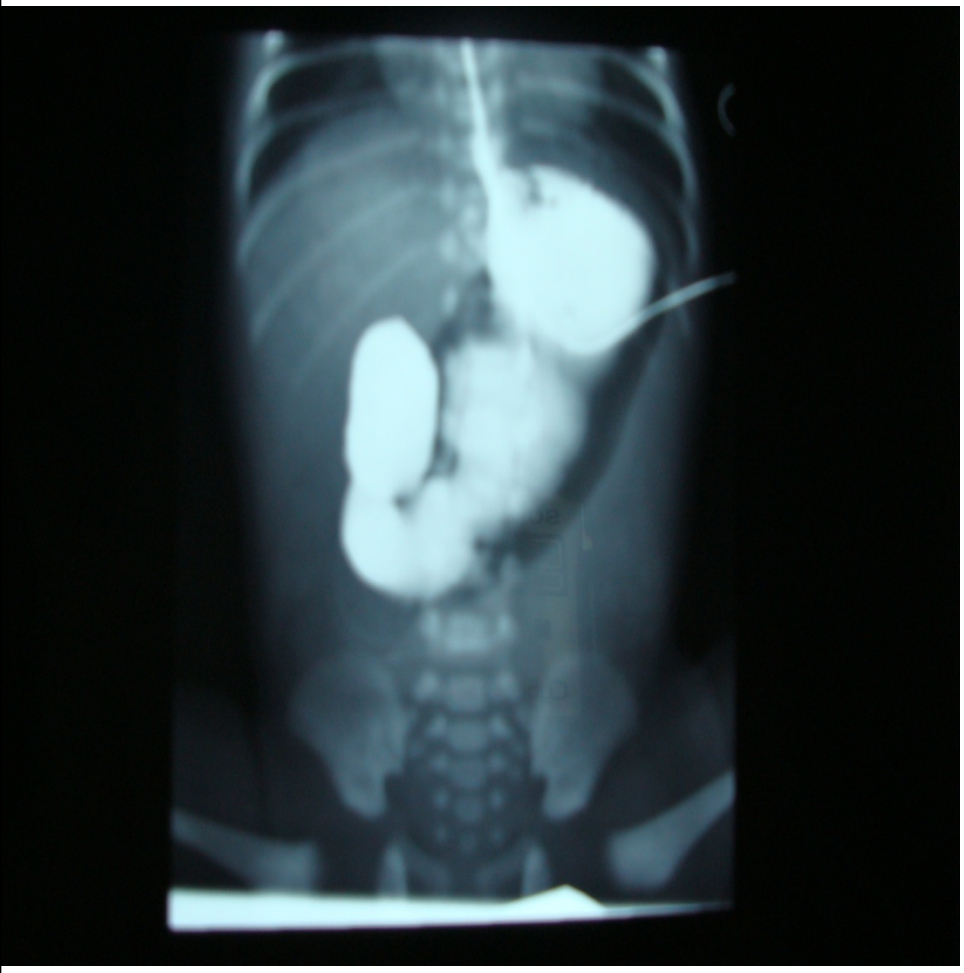


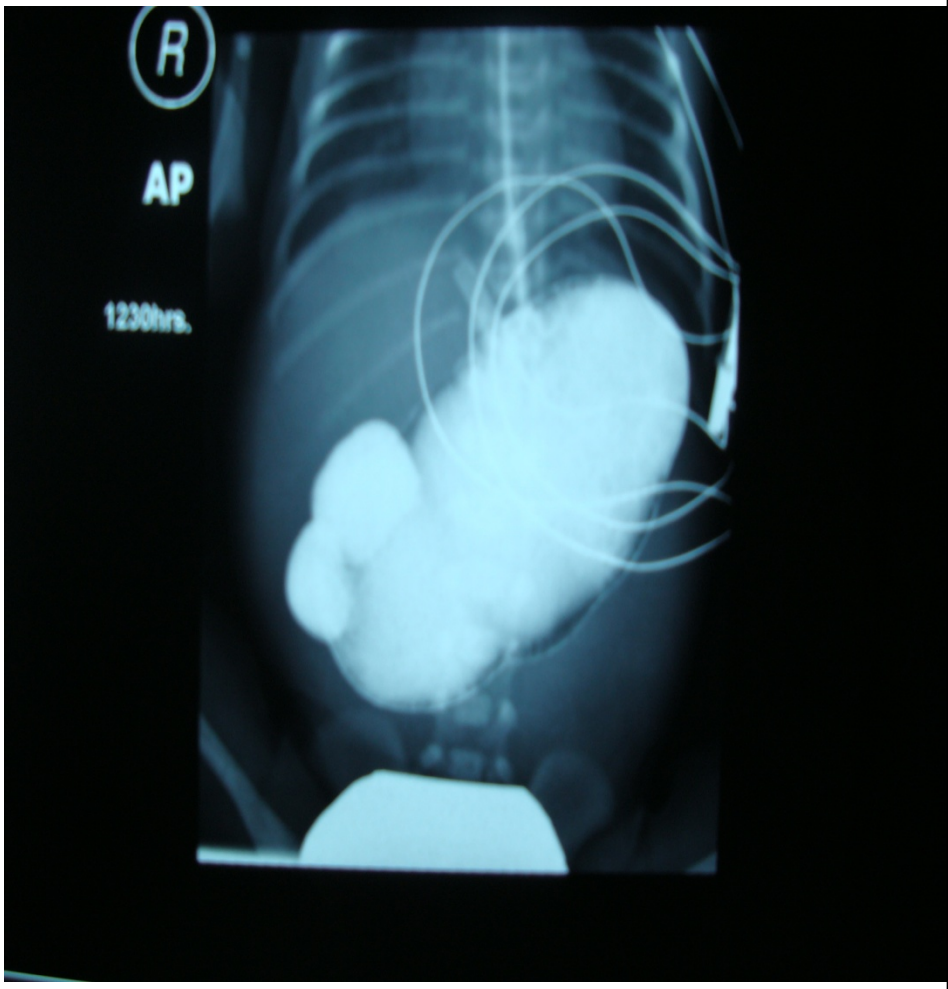
New born baby came with reccurent vomitting

* Single bubble sign

Hypertrophic pyloric Stenosis

* مافيه ولاأي نقطة Contrast طلعت برى الـ Stomach




R
AP
1230hrs.

Barium follow-through

- Is the investigation of the small intestine with contrast - medium (usually barium sulfate)
- Transit of barium is observed through the small bowels .
- Full-length abdominal films are taken every half hour until barium reaches the large bowel .
- Spot films of the terminal ileum are obtained .

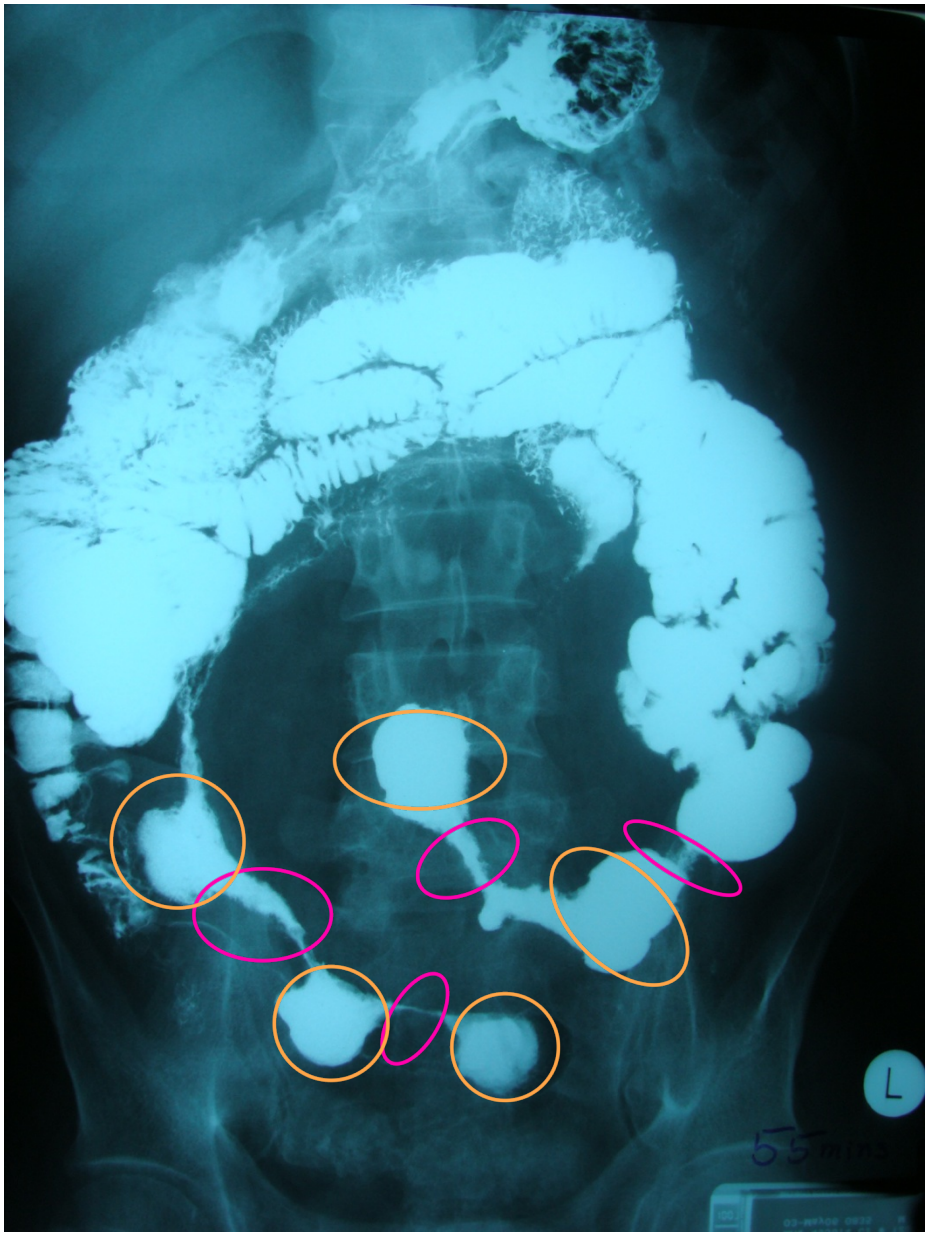
Indication :

أهم منطقة ؛ لأنه معظم الـ diseases بتصير هون ←

*الأطفال ما بصير نعمل لهم spot films لأنه كل جسمهم فيه انقسامات في الخلايا .

- ❖Inflammatory bowel disease, most often Crohn's disease.
- ❖Small bowel tumors / lymphoma
- ❖Small bowel obstruction

Barium follow through



Narrowing

Dilatation

Skip lesions of Chrohn's disease

Barium enema

نوع من أنواع التعذيب

* قبل بيوم يتم تحضير المريض لتفريغ ال Large bowel
- Fasting
- laxatives

- Is the study of the large bowel with double contrast (Barium and air).

بنفخ بالون وبنشده حتى نسكر ال anus

- Barium is run into the colon by Foleys catheter placed in the rectum.

2 liters → Rectum → Segmoid → Descending → Transverse → Ascending → بس نوصل لهون بنسكره (بنوقف ادخال ال Barium)

↓ بنخلي المريض يفرغه بالحمام، بس مارح يفرغه كله يعني رح يظل شوي

- Air insufflation into the large bowel produces a double contrast examination .

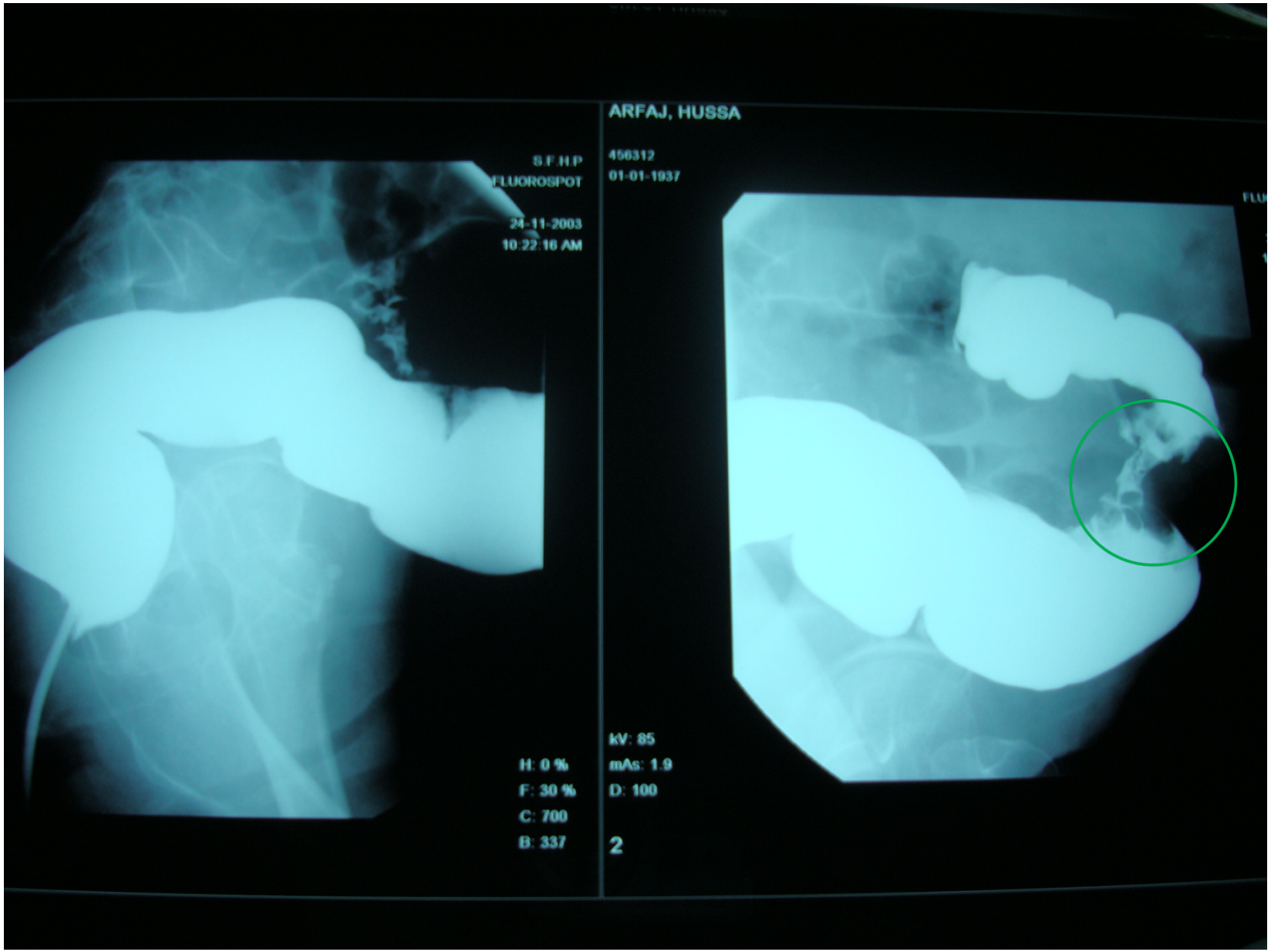
بيرتجع ال Barium على ال walls وبصير stretching

Indication :

- ➢ Investigation of abdominal mass
- ➢ Large bowel obstruction / volvulus.
- ➢ Diverticular disease
- ➢ Suspected colonic tumor

*المفروض نكون معطيين المريض
- Muscle relaxants
وبننفخ شوي شوي وبنستنا لأنه ال Muscle stretching مؤلم جداً

Double contrast barium enema



* Apple-Core appearance
* Colorectal cancer

Small bowel obstruction → Adhesions → Hernia

- Mechanical small bowel obstruction develops when there is impairment to the onward flow of bowel contents.
- Gas and fluid accumulating proximal to the site of obstruction causing progressive dilatation of small bowel.
- The initial radiological investigation for suspected small bowel obstruction is supine and erect plain abdominal films.

Causes of small bowel obstruction

The most common causes are:

- **Adhesions:** is the most common cause, about 70% of cases.
- Strangulated hernias
- Tumors of small bowels
- Inflammatory bowel disease

What are the common signs of small bowel obstrucion ?

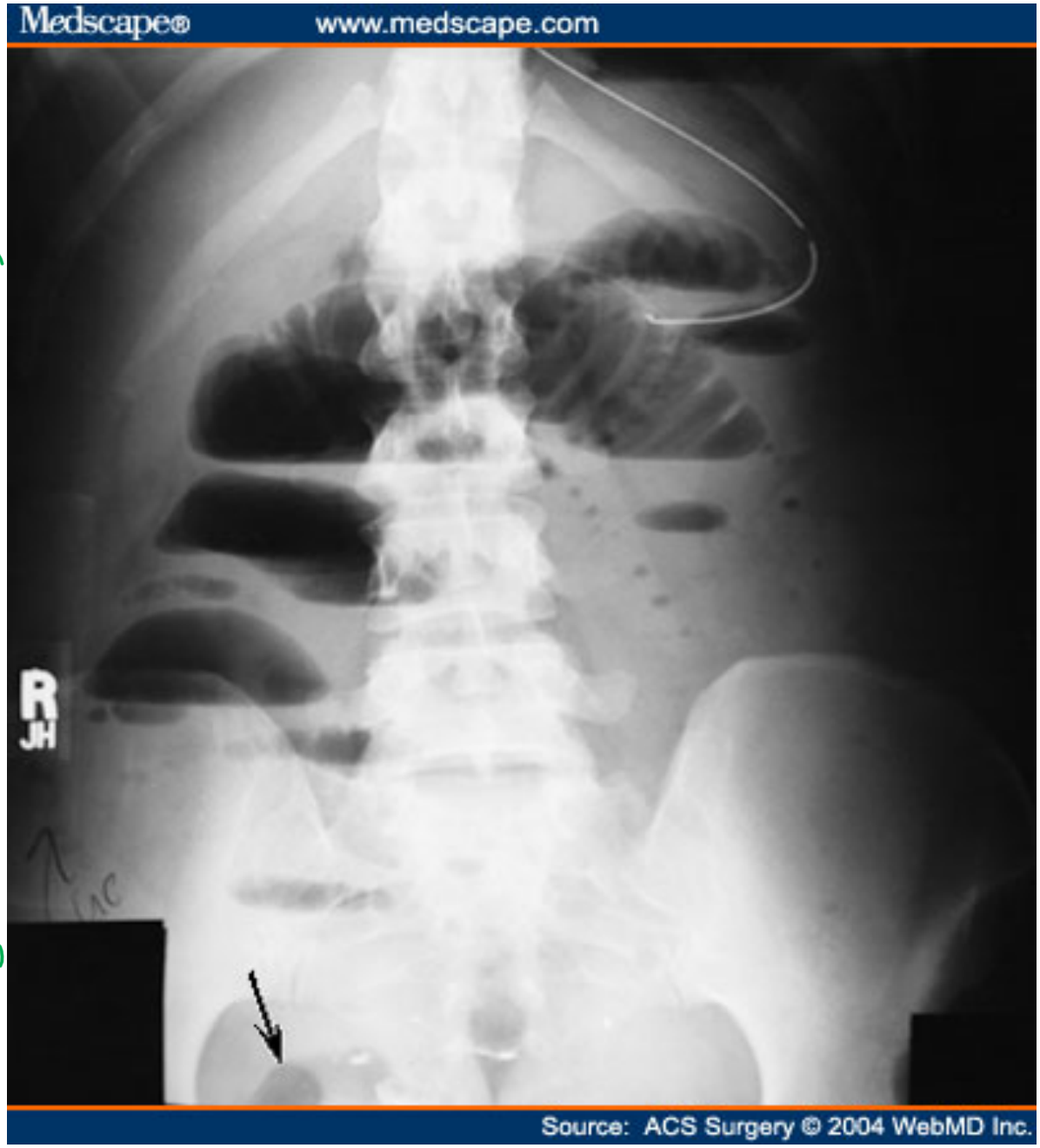
- Dilatation of small bowel loops, usually centrally placed in abdomen.
- Multiple air fluid levels.
- Absence of gas in the colon.
- If gas is still present, it indicate that the obstruction is recent or that it is incomplete.

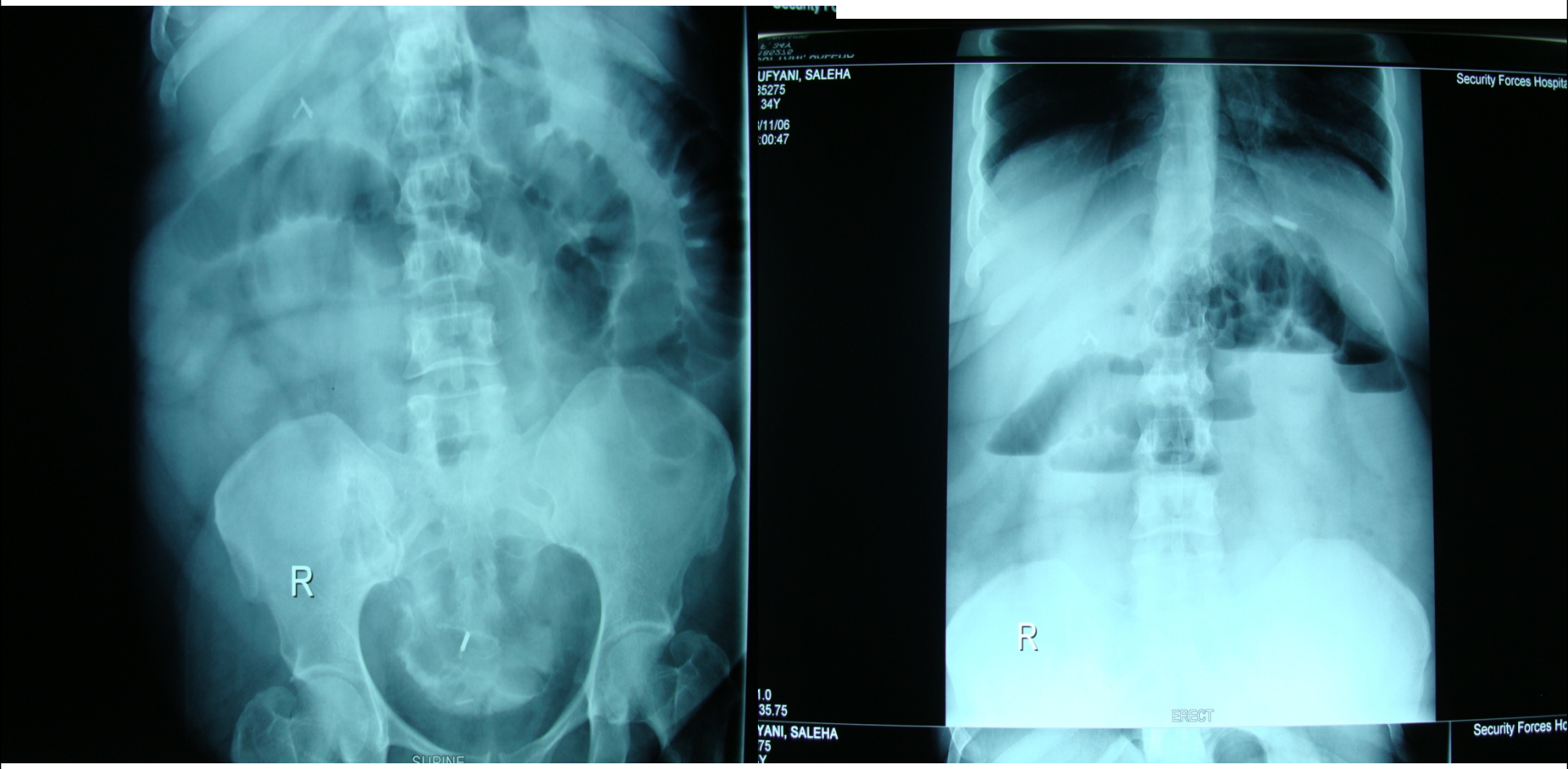
Distinction between small and large bowel dilatation

	Small bowel	Large bowel
Distribution of loops	Central	Peripheral
Number of loops	Many	Few
Diameter	2.5-3 cm	5-7 cm
Haustra	Absent	Present
Valvulae conniventes	Present in jejunum	Absent
Solid feces	Absent	Present

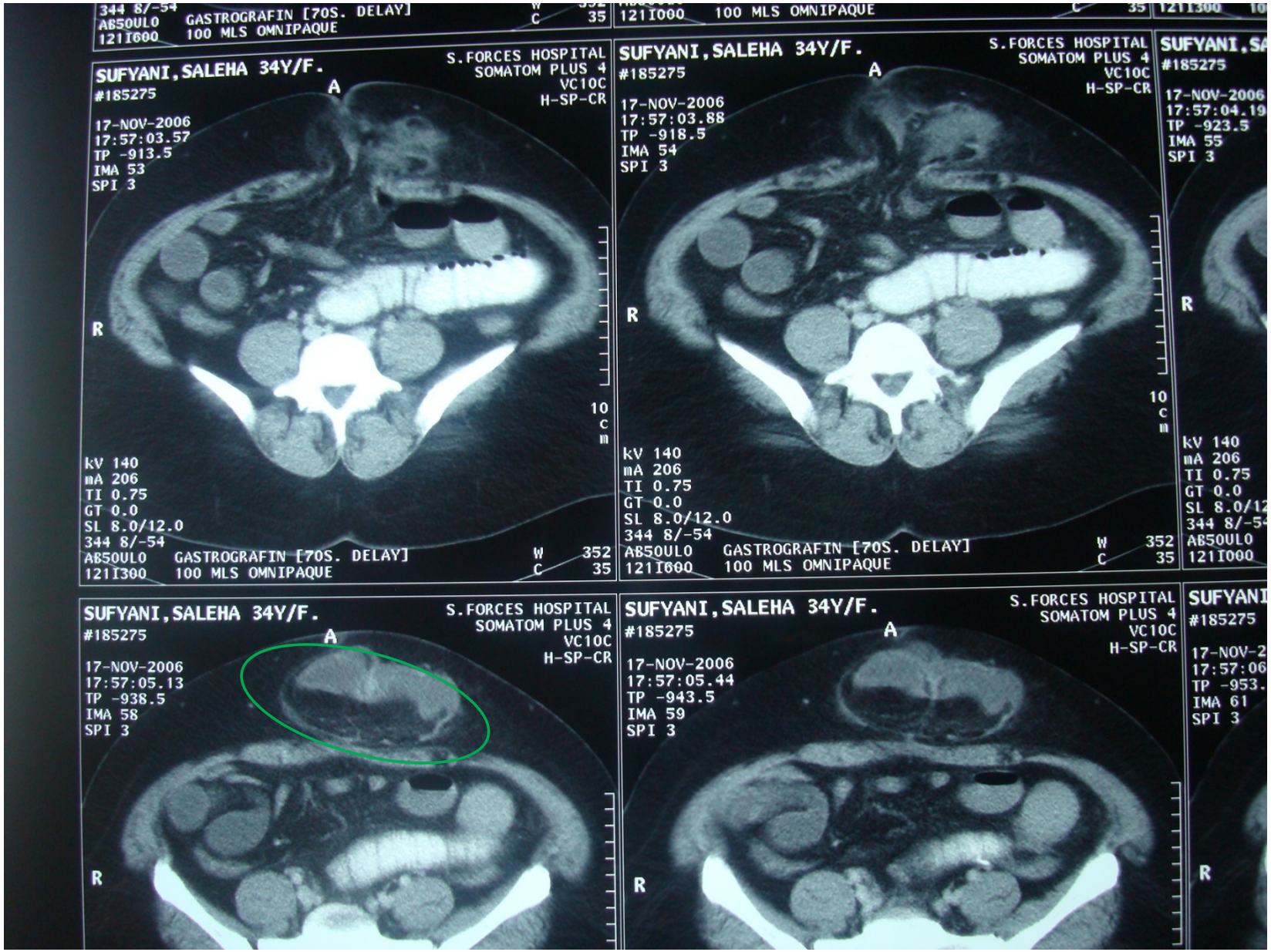
Plain abdominal x-ray

Multible dilated bowel loobs Centrally located in the abdomen most likely to be Small bowel obstruction





Plain abdominal x-ray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#185275
S.FORCES HOSPITAL
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SPI 3
kV 140
mA 206
TI 0.75
GT 0.0
SL 8.0/12.0
344 8/-54
AB50ULO GASTROGRAFIN [70S. DELAY]
121I300 100 MLS OMNIPAQUE
W 352
C 35
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IMA 58
SPI 3
SUFYANI,SALEHA 34Y/F.
#185275
17-NOV-2006
17:57:05.44
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IMA 59
SPI 3

Hernia

Large bowel obstruction

- The plain abdominal film is useful for the diagnosis of large bowel obstruction.
- The large bowel proximal to the obstruction is dilated.
- Fluid levels are present in the erect position and tend to be long.
- In equivocal cases, a barium enema can be performed and locate the site and cause of obstruction.

Large bowel obstruction / 2

Most common Causes of large bowel obstruction:

- Colonic carcinoma
- Diverticulr disease
- Volvulus of sigmoid colon.
- Paralytic ileus: causes small and large bowel obstruction, especially in the post operative stage

Air under the diaphragm

- Free abdominal air is called pneumoperitonium and is usually due to perforation.
- It accumulates under one or both diaphragms when the patient is in erect position.
- Lateral decubitus film can be used for very ill patients.

❑Free air is not seen in up to 20% of patients.

Causes of free abdominal air

- Post laparotomy or laparoscopy.

  (are usually absorbed within 1 week)

- Post peritoneal dialysis.

- Viscus perforation, the most common causes are:

  - perforated peptic ulcer
  - perforated appendix (appendicitis)
  - rupture diverticulum (diverticulitis)

Air under diaphragm

*مثلاً واحد عمل عملية في الـ abdomen وصوروه بعد يومين وجدوا عنده

كيف بدنا نعرف إذا من العملية ولا صار عنده Perforation؟ ساعة إلى ساعتين

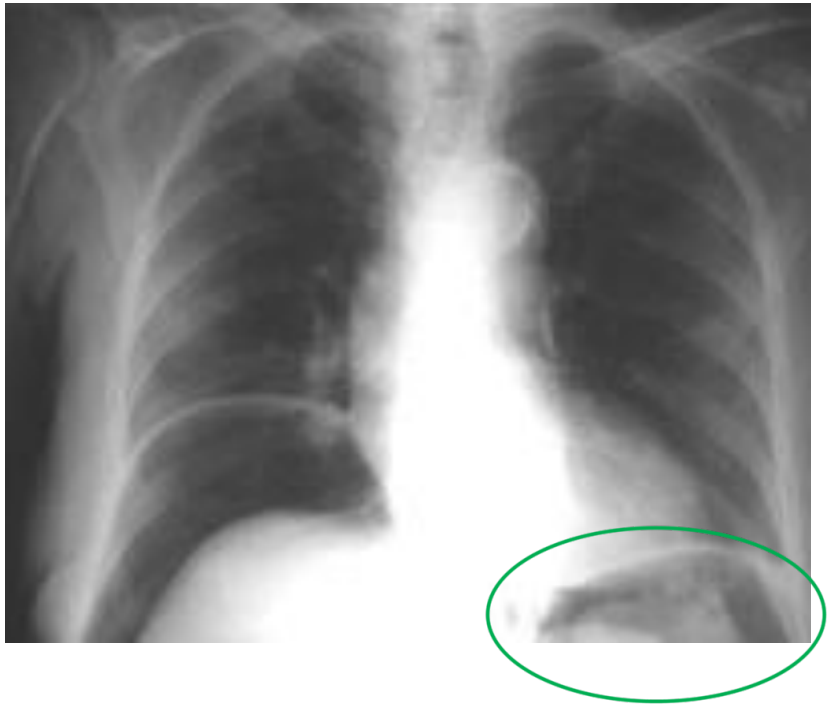
Perforation ← إذا زاد

من العملية. ← إذا قلّ

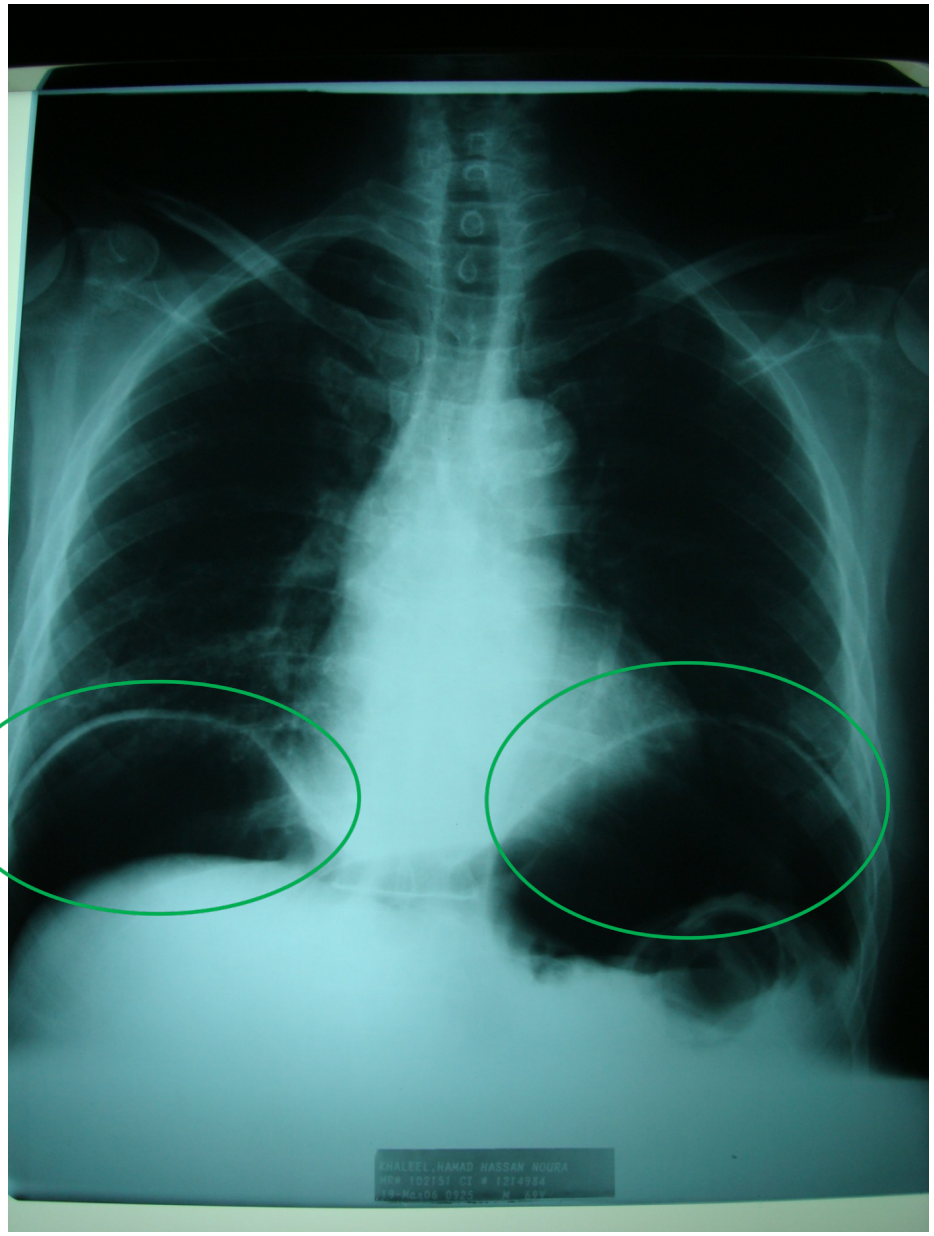
- بنأخذ الصورة Baseline وبنصوره صورة ثانية بعد فترة وبنشوف

4 things you can do to differentiate between Gastric or free abdominal air.

1- CT-scan
2- Wait for a time then take another image
3- Turn the patient to the left lateral position
4- Give the patient Gastrografin



Gas



Gas under diaphragm ←

Radiology of the liver, Gallbladder And Biliary system

Plain film is used for:

- Detection of radio-opaque calculi.
- Calcification in the liver or in the gallbladder wall.
- Gas in the biliary tree.

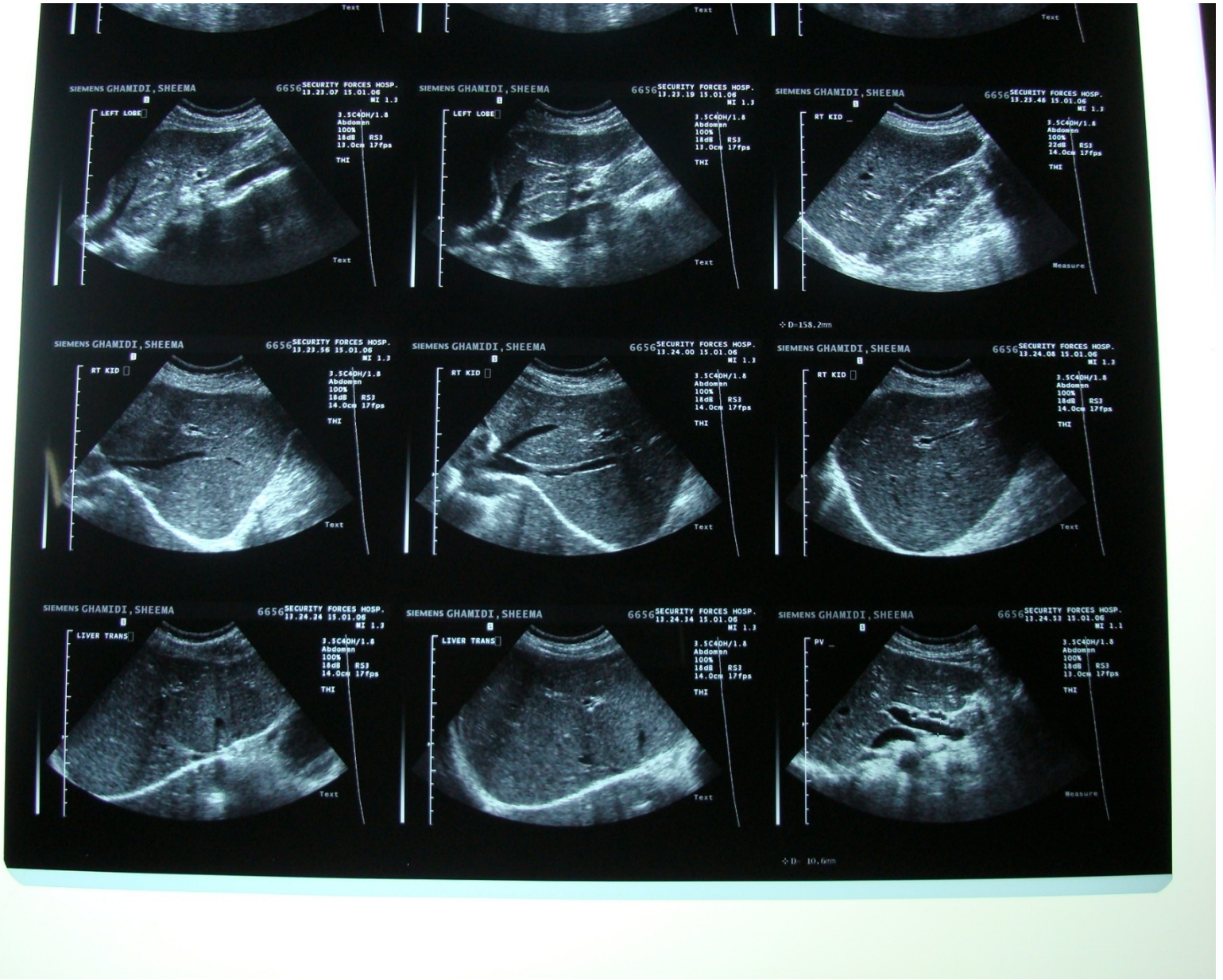
Ultrasound and CT of the liver

- Liver ultrasound is an accurate imaging modality for focal or diffuse disease of the liver, staging primary tumors, detecting secondary deposits
- Ultrasound will visualize the gallbladder, CBD, hepatic and portal veins.
  ↳ Common bile duct
- If ultrasound is not conclusive for liver disease or mass lesion, CT is indicated.
- CT demonstrate the full range of liver disease, including cirrhosis and tumors.

Liver MRI

- MRI provide excellent images of the liver as does CT, but without the risk of radiation.

- Blood vessels and bile ducts may be shown without injection of contrast by using magnetic resonance angiography (MRA) and magnetic resonance cholangiography (MRCP).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LEFT LOBE
3.5C4DH/1.8
Abdomen
100%
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13.23.19 15.01.06
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LEFT LOBE
3.5C4DH/1.8
Abdomen
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THI
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RT KID
3.5C4DH/1.8
Abdomen
100%
22dB RS3
14.0cm 17fps
THI
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D=158.2mm
SIEMENS GHAMIDI, SHEEMA
6656 SECURITY FORCES HOSP.
13.23.56 15.01.06
MI 1.3
RT KID
3.5C4DH/1.8
Abdomen
100%
18dB RS3
14.0cm 17fps
THI
Text
SIEMENS GHAMIDI, SHEEMA
6656 SECURITY FORCES HOSP.
13.24.00 15.01.06
MI 1.3
RT KID
3.5C4DH/1.8
Abdomen
100%
18dB RS3
14.0cm 17fps
THI
Text
SIEMENS GHAMIDI, SHEEMA
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13.24.08 15.01.06
MI 1.3
RT KID
3.5C4DH/1.8
Abdomen
100%
18dB RS3
14.0cm 17fps
THI
Text
SIEMENS GHAMIDI, SHEEMA
6656 SECURITY FORCES HOSP.
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MI 1.3
LIVER TRANS
3.5C4DH/1.8
Abdomen
100%
18dB RS3
14.0cm 17fps
THI
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13.24.34 15.01.06
MI 1.3
LIVER TRANS
3.5C4DH/1.8
Abdomen
100%
18dB RS3
14.0cm 17fps
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SIEMENS GHAMIDI, SHEEMA
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PV
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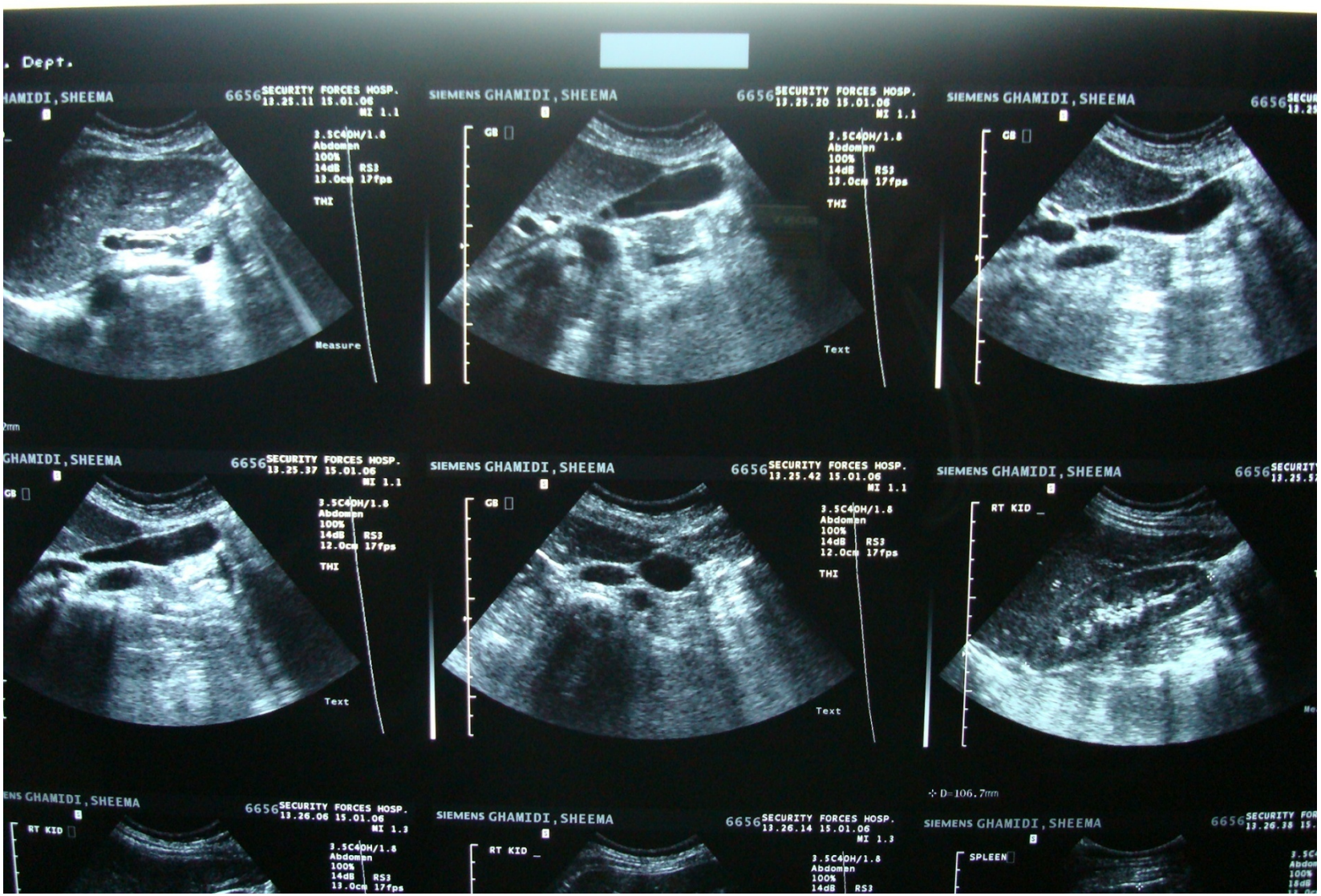
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SIEMENS GHAMIDI, SHEEMA
GB
6656 SECURITY FORCES HOSP. 13.25.20 15.01.06 MI 1.1
3.5C40H/1.8 Abdomen 100% 14dB RS3 13.0cm 17fps THI
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GB
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RT KID
D=106.7mm
SIEMENS GHAMIDI, SHEEMA
RT KID
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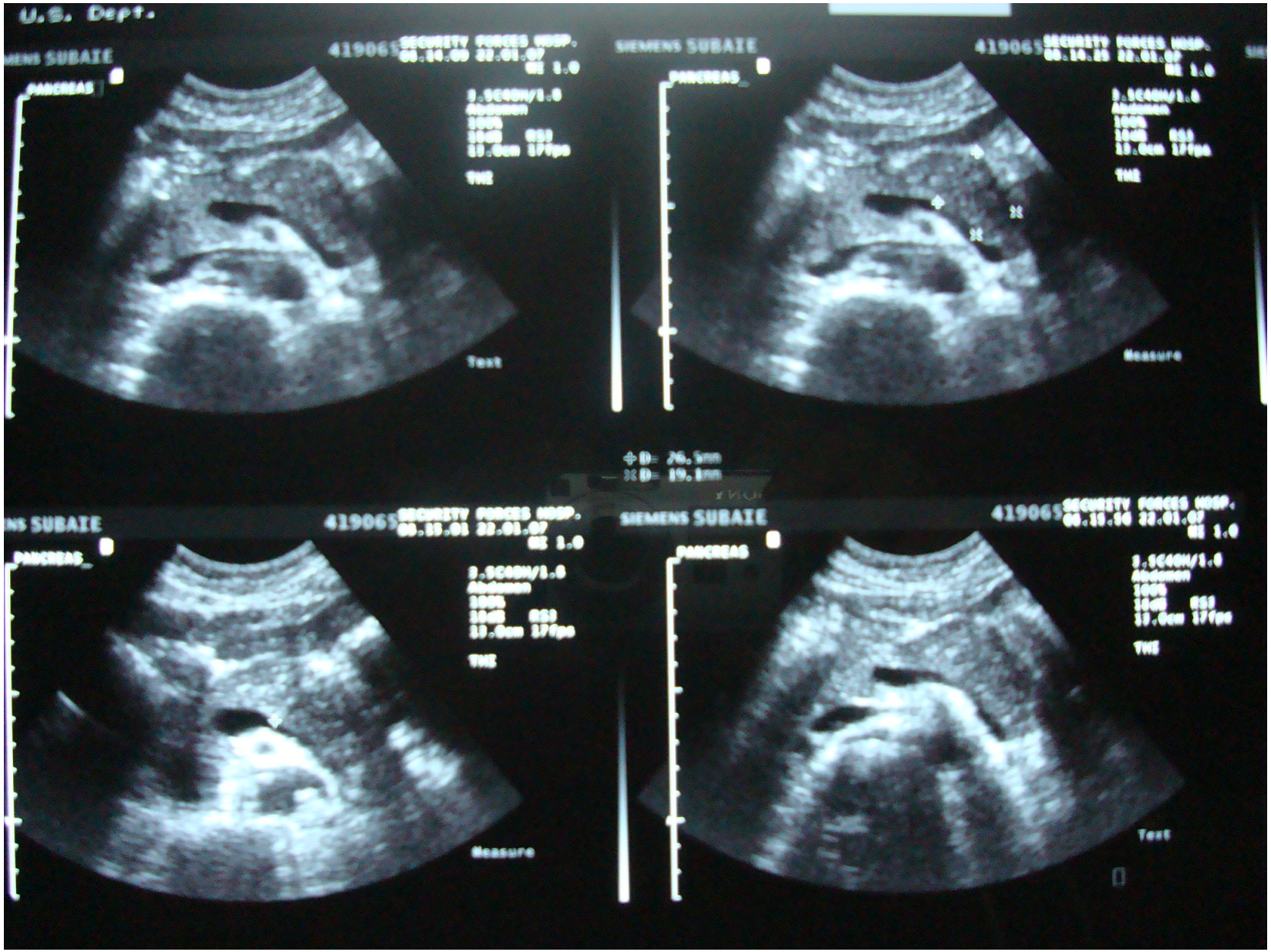
SIEMENS GHAMIDI, SHEEMA
SPLEEN


U.S. Dept.
SIEMENS SUBAIE
PANCREAS
Text
Measure
D= 26.5mm
D= 19.1mm

GALLSTONES

- **Stones in the gallbladder are relatively common and occur in approximately 10% of population.**
- **Types of gallstones:**

❖ **Cholesterol gallstones:** are the most common, accounting for more than 80 % of cases.

❖ **Pigment gallstones:** usually form when there is excess bilirubin and calcium salts in bile.

❖ **Mixed stones:** are mixture of cholesterol and calcium salts.

The predisposing causes include:

- Obesity, diabetes, liver cirrhosis, and blood disorders such as sickle-cell anaemia.

Radiological features of gallstones

- Plain film reveal approximately 10 to 20% of calculi as they are radio-opaque.
- Ultrasound is the best test for gallstones, which is non-invasive and very accurate.
- A gallstone on ultrasound is echogenic, it appears as a white structure that casts a dark shadow behind it.

Acute cholycystitis → Destended gallbladder

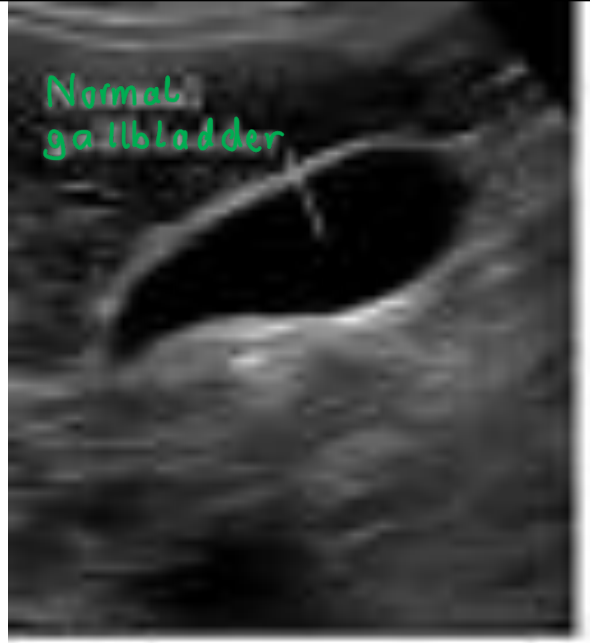
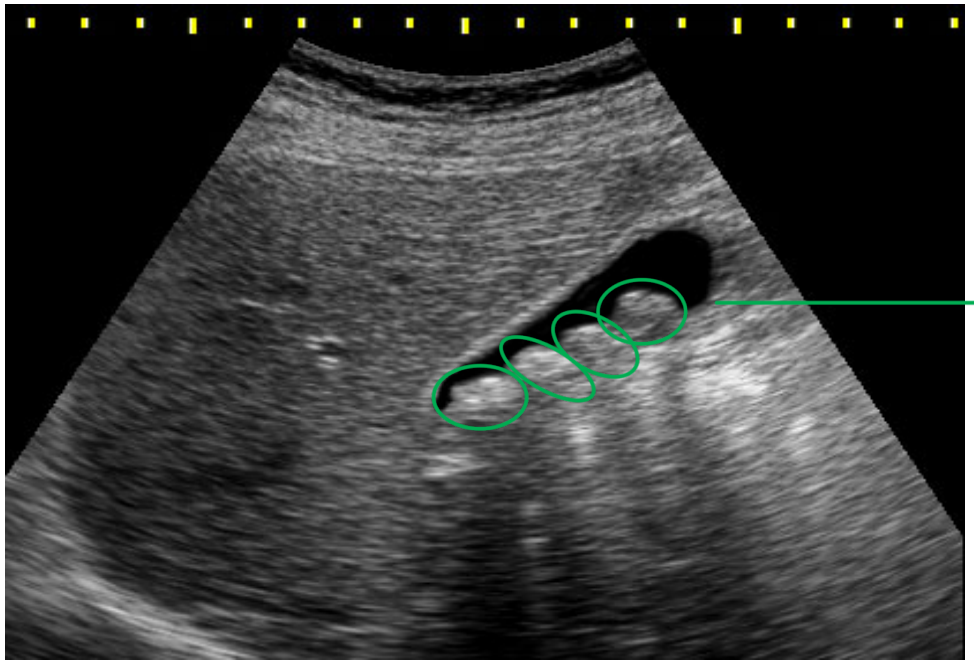


Figure 1

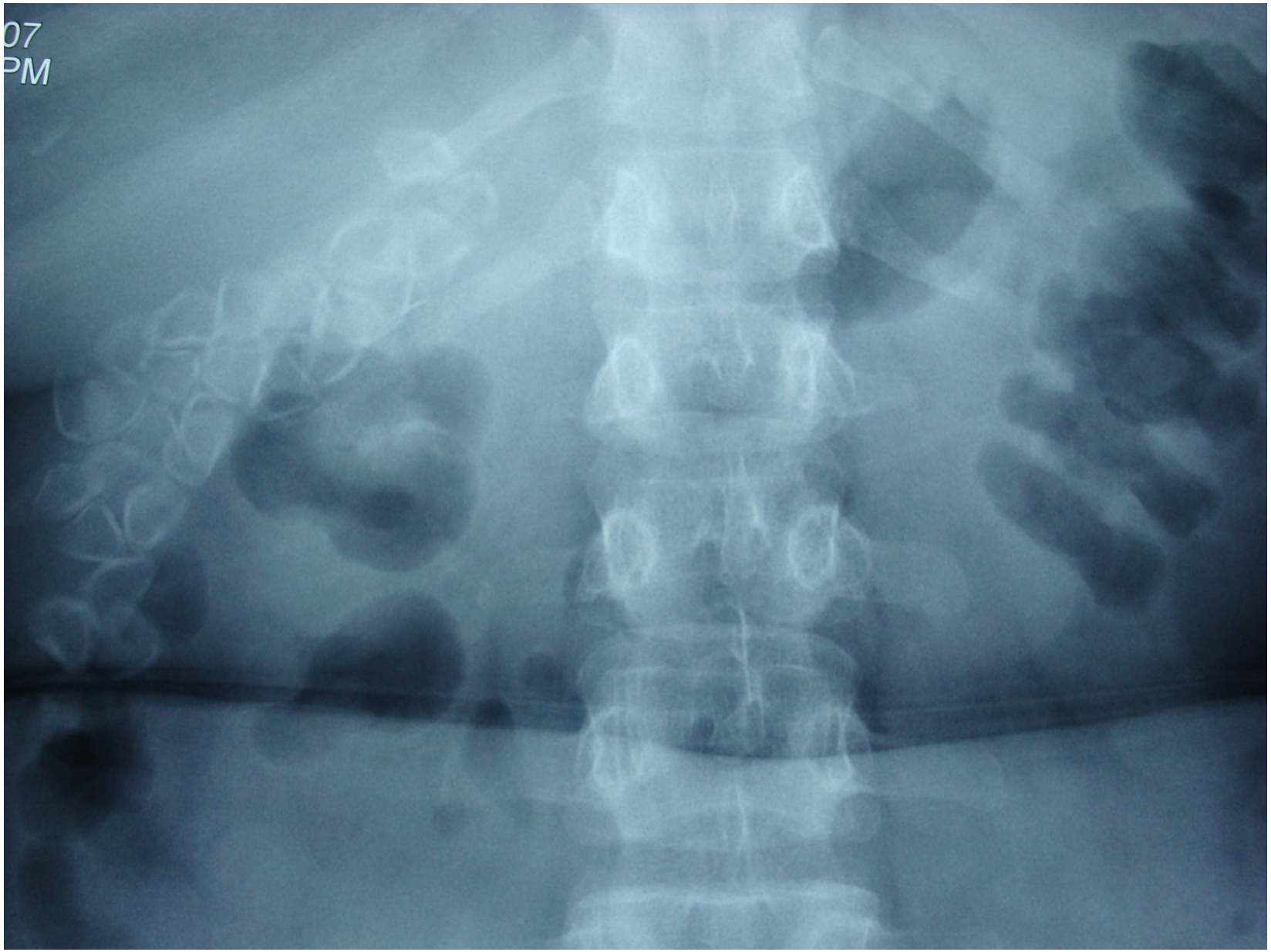
Figure 2



Stones in the bladder

Only 15% of Gallbladder stones appear on x-ray

عكس ال Renal stones

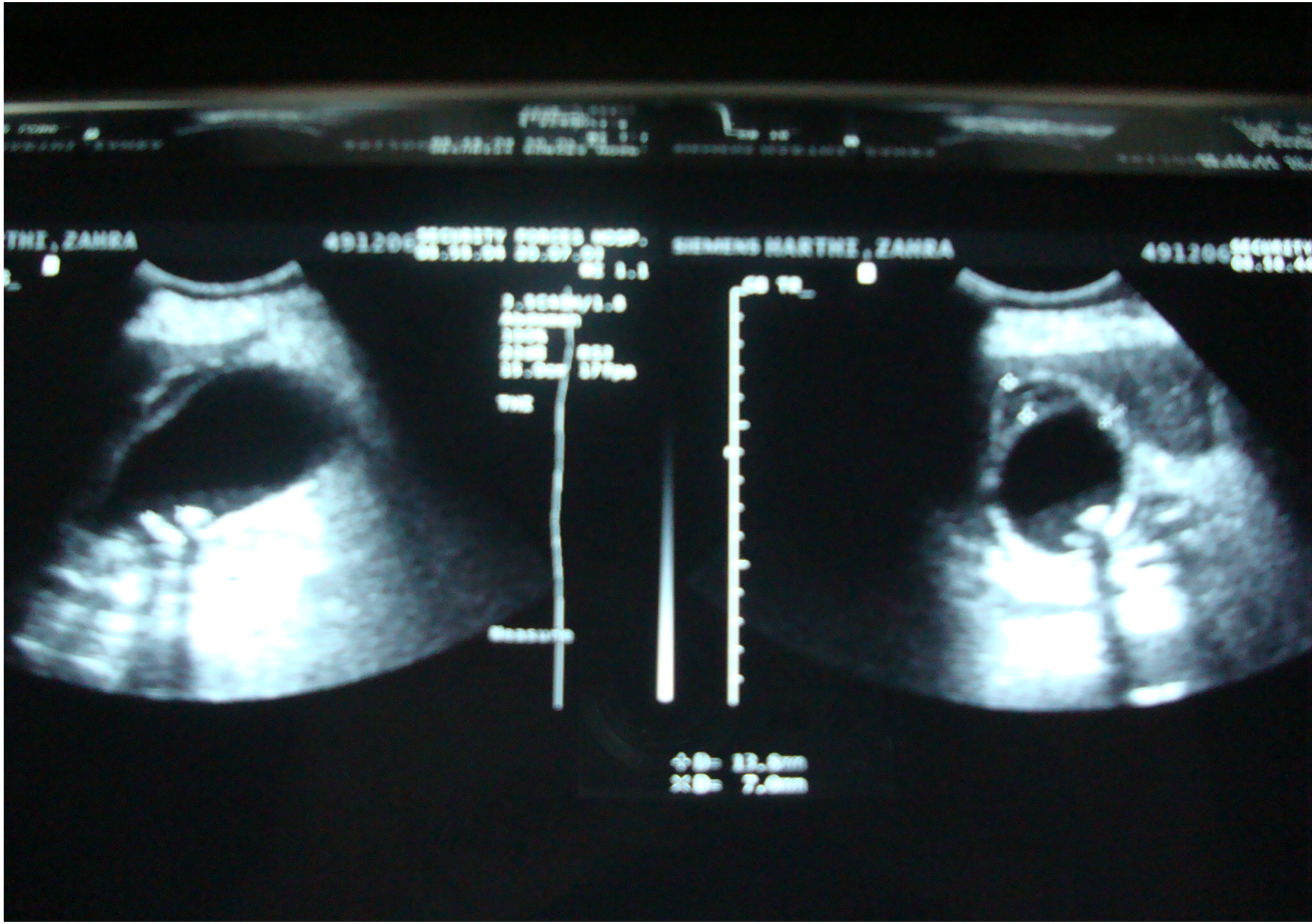

07
PM

Acute cholecystitis

- Is a sudden inflammation of the gallbladder that causes severe abdominal pain.
- In the vast majority of cases this result from stone obstructing the cystic duct which lead to infection of static bile and the gallbladder mucosa.

The ultrasound features are:

- ❖ Distended gallbladder with gallstones.
- ❖ The gallbladder wall is thickened (greater than 3 mm) and edematous
- ❖ Pericholecystic fluid, and in some complicated cases pericholecystic abscess.


SIEMENS HARTHI, ZAHRA

Acalculous cholecystitis

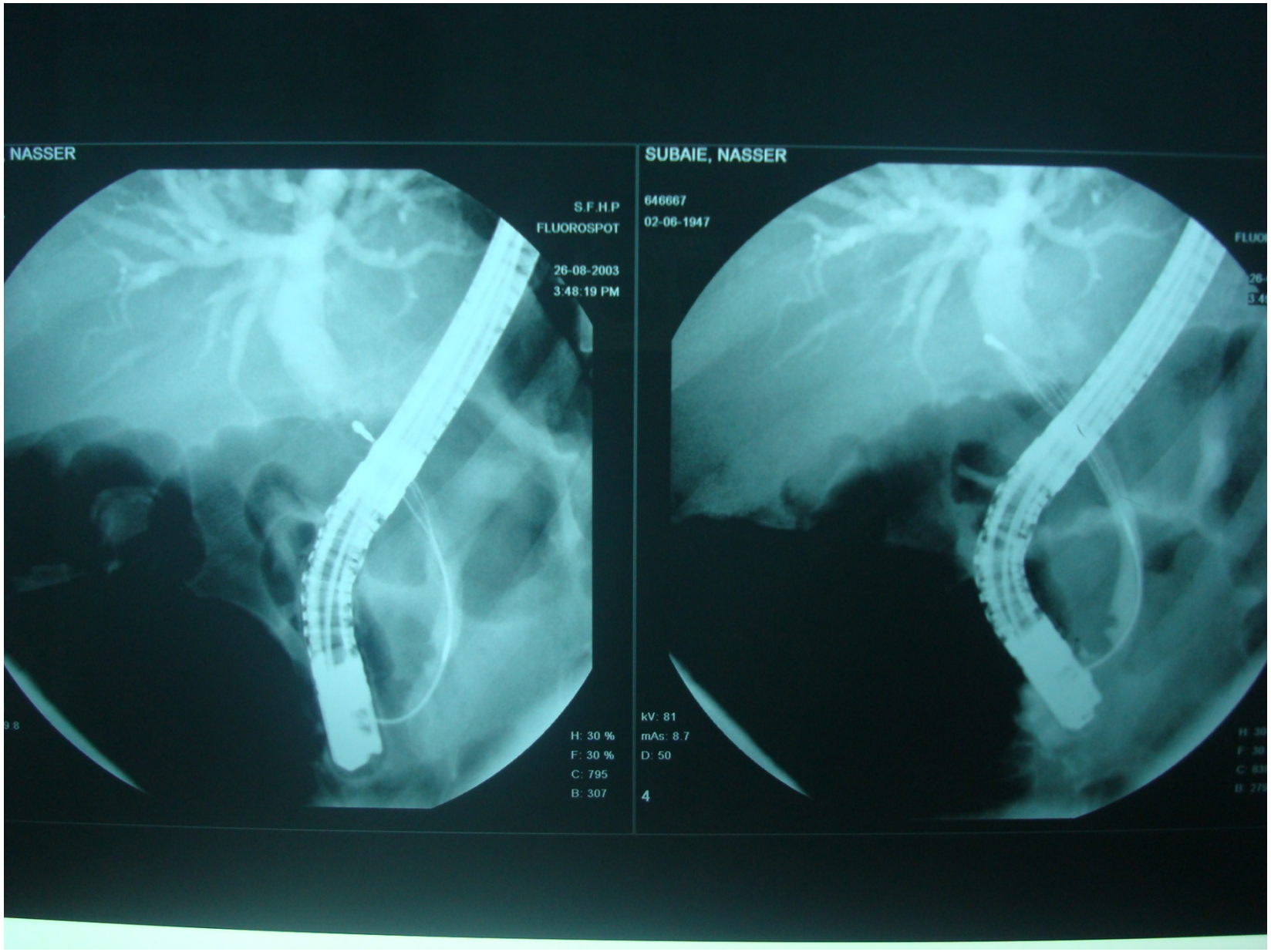
- Cholecystitis can develop in patients without gallstones, but it is rare.
- Hospitalized patient, such as those in cardiac intensive care units, are most likely to develop this condition, which may be due to ischemia.

Endoscopic retrograde cholangiopancreatography (ERCP)

Indication:

- Obstructive jaundice
- Removal of known CBD stones
- Pancreatic tumors, that cause bile duct obstruction and jaundice

- An endoscope is introduced and advanced through the mouth into the duodenum, with injection of contrast into the ampula of Vater, to demonstrate both the bile ducts and the pancreatic ducts.
- CBD stones can be removed through the endoscope by insertion of a catheter with a basket or balloon.
- Malignant CBD strictures can also be stented.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H: 30 %
F: 30 %
C: 795
B: 307
SUBAIE, NASSER
646667
02-06-1947
kV: 81
mAs: 8.7
D: 50
4


Thank
You

findings

US : nature of the tumor : solid, semisolid, cystic, fatty

MRI : can detect small nodules
↳ female of younger age

BREAST IMAGING

dense breast
① young age
(dense gradular tissue)
→ useless (US / MRI)
② lactating & pregnant
(active tissue full of tissue)

an منتشر ، بيصير fatty واصلا تغير ال lesion فيه

clinical exam & screen → 40 each year

risk factor → 35

less than that 35 → US / MRI / biopsy

mamogram ال بعد biopsy ال ، بعد آخرشيا

20-40 : clinical exam each 3 years

large fibroadenoma : biopsy & remove

small : follow up each year

Introduction and History

- Breast cancer is **2nd** only to lung cancer as cause of death in women
  - Very treatable with early detection! –
- 1st innovation since radical mastectomy introduction in 1898
- In 1913, radiographic appearance of ***breast cancers was first reported*** –
- Mammography became a reliable diagnostic tool in 1950s when industrial grade x-ray film introduced

signs & mass
nipple inversion
nipple discharge
axillary LN pathology
pain
nipple dystrophy
& changes in skin

- 1960's – **Xerography** introduced – much lower dose
- Research conducted in 1970s clearly showed mammography to be essential part of early diagnosis
- 1975 – High speed/resolution **film** introduced by DuPont
- 1992 – MQSA implemented (Mammography Quality Standards Act)

WHAT IS MAMMOGRAPHY?

- Mammography is a special type of X-ray imaging used to create detailed imaging of the breast.
- It **uses low-kV** X-ray, **high contrast, high-resolution film and** an X-ray system **designed** specifically for imaging the breasts.

CI's Breast feeding
young age
, pus/painful tension
, infection abcess

Definition of breast cancer:

- Cancer that forms in tissues of breast, usually **ducts** (tubes that carry milk to nipple) and **lobules** (glands that make milk).
- Occurs in both men and women (male breast cancer is rare)

Risk v. Benefit

Breast cancer in United States in 2009 (estimated):

New cases: 192,370 (female); 1,910 (male)
Deaths: 40,170 (female); 440 (male)

Us population 306 million in 2007- 133 deaths /million

Mortality risk from mammography induced radiation is 5 deaths/ million pts. using screen film mammography

More risky to refuse mammography!

Breast Cancer: Why Screen?

- High prevalence
- Improved outcome by treatment during the asymptomatic period
- Significant impact on public health

Mortality Reduction

- Due to detection of cancers at smaller size/earlier stage
  - Mammographically visible 3-5 years before palpable
  - Increased detection of DCIS
- **Early stage disease is curable**

RISK OF MAMMOGRAPHY

- Average glandular dose from a screening mammogram is extremely low
- Comparable risks are:
  - Traveling 4000 miles by air
  - Traveling 600 miles by car
  - 15 minutes of mountain climbing
  - Smoking 8 cigarettes

MAMMOGRAM

1- SCREENING MAMMOGRAM

2- DIAGNOSTIC MAMMOGRAM

Screening Versus Diagnostic Tests

- Screening evaluates a population of ASYMPTOMATIC people at risk for disease
- Goals
  - High sensitivity for disease
  - Low false negative rate
  - Lower specificity acceptable

Diagnostic Accuracy of Screening Mammography

- Sensitivity in women > 50 y.o.
  - 98% fatty breast
  - 84% dense breasts
- Specificity
  - 82-98%

SCREENING VS DIAGNOSTIC MAMMOGRAPHY

- Screening mammography
  - Uses X-rays to image the breast to identify abnormalities that may represent cancer
  - Patients asymptomatic
  - Generally, the radiologist does not see films until the patient has left the radiology department

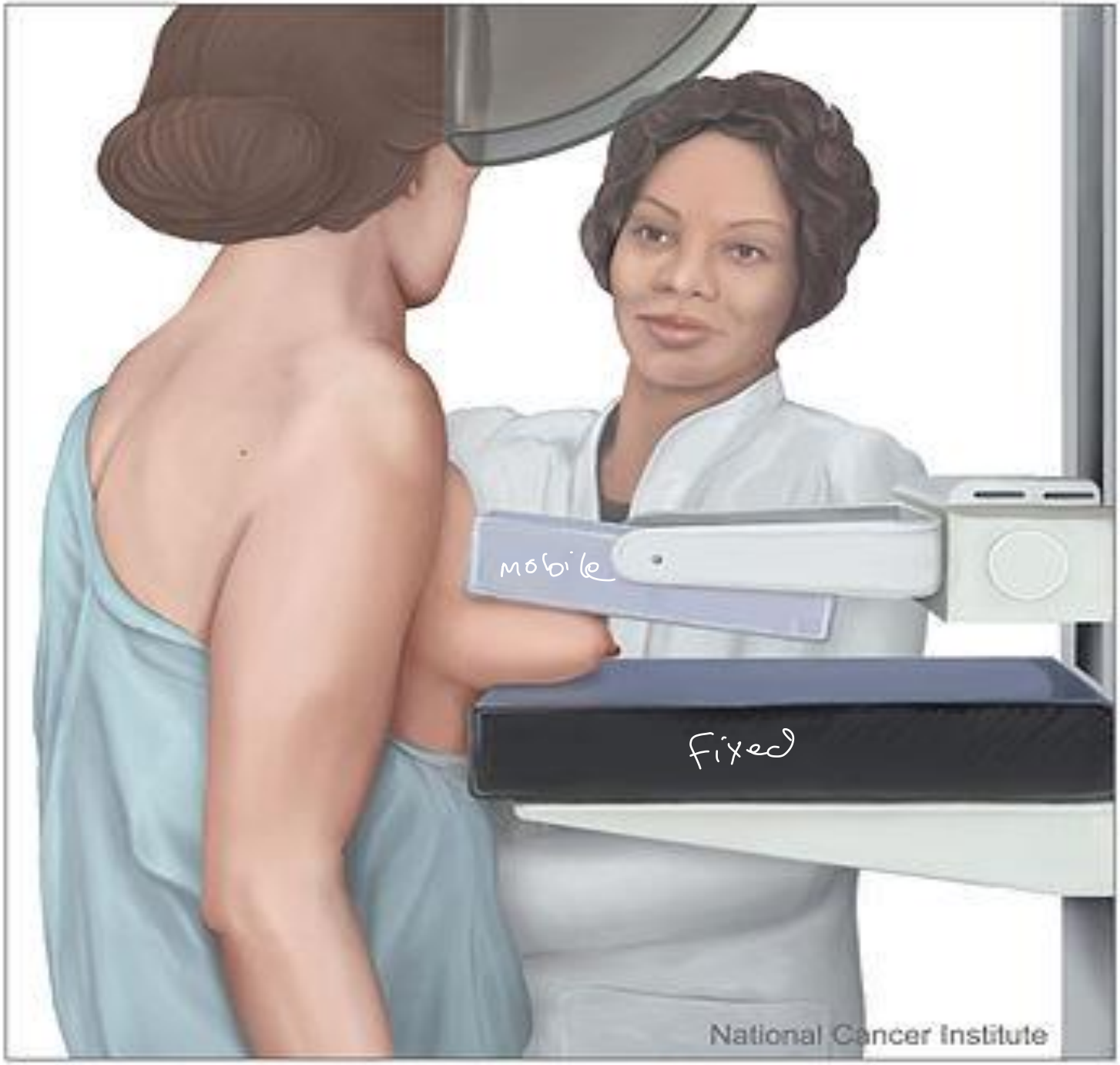
SCREENING VS DIAGNOSTIC MAMMOGRAPHY

- Diagnostic mammography
  - Patients with breast signs or symptoms (palp lump, pain, nipple discharge)
  - Patients with abnormality detected on screening mammogram
  - Performed under the supervision of a radiologist
  - Additional specialized mammographic views

Screening Mammography

- Consists of two images of each breast
  - Craniocaudal (CC)
  - Medial-lateral-oblique (MLO)

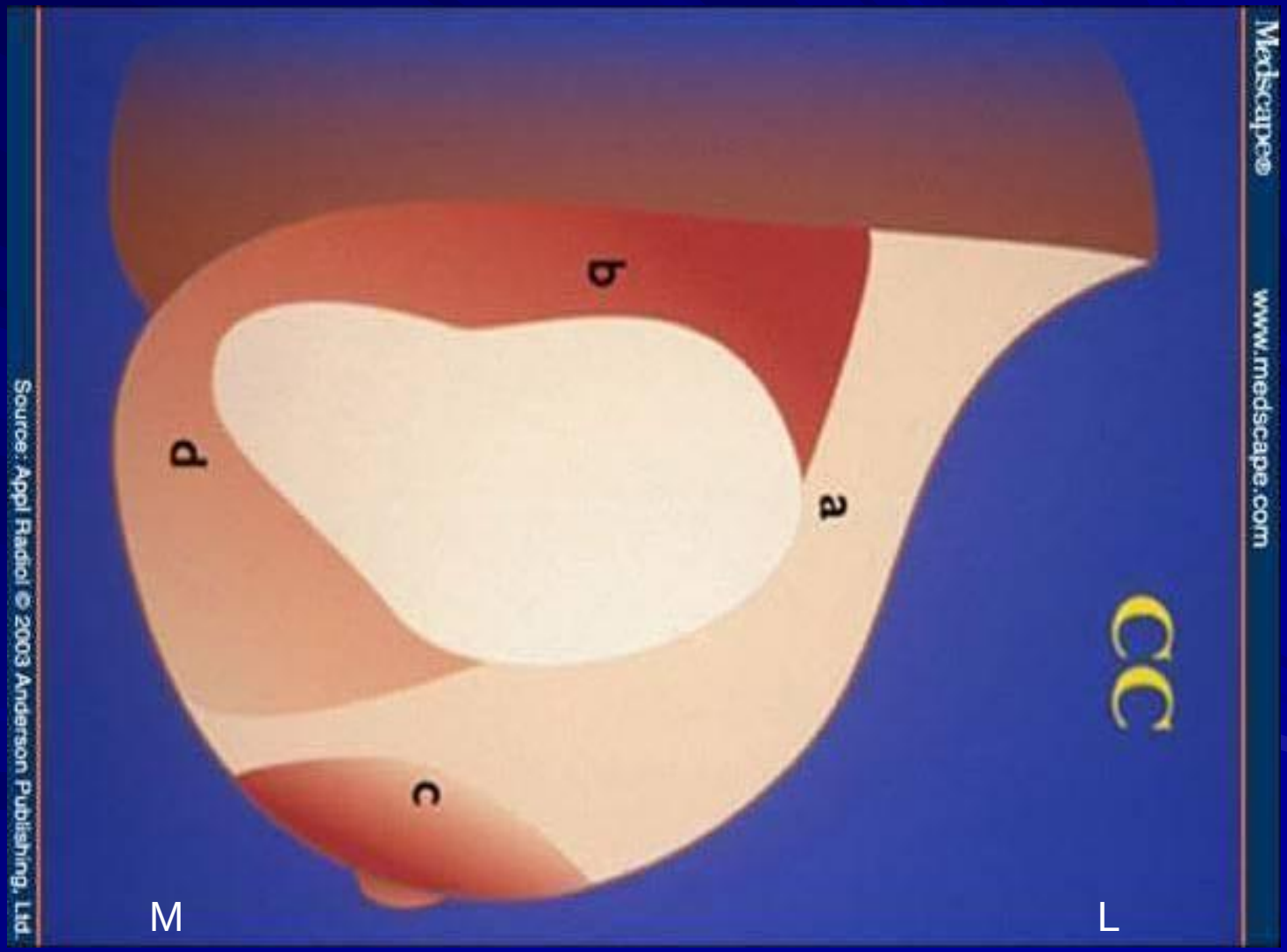
← compression & squeezing the tissue → ↑ contrast (↓ blur)
↓ field of radiation
↓ patient dose
↑ resolution


mobile
Fixed
National Cancer Institute

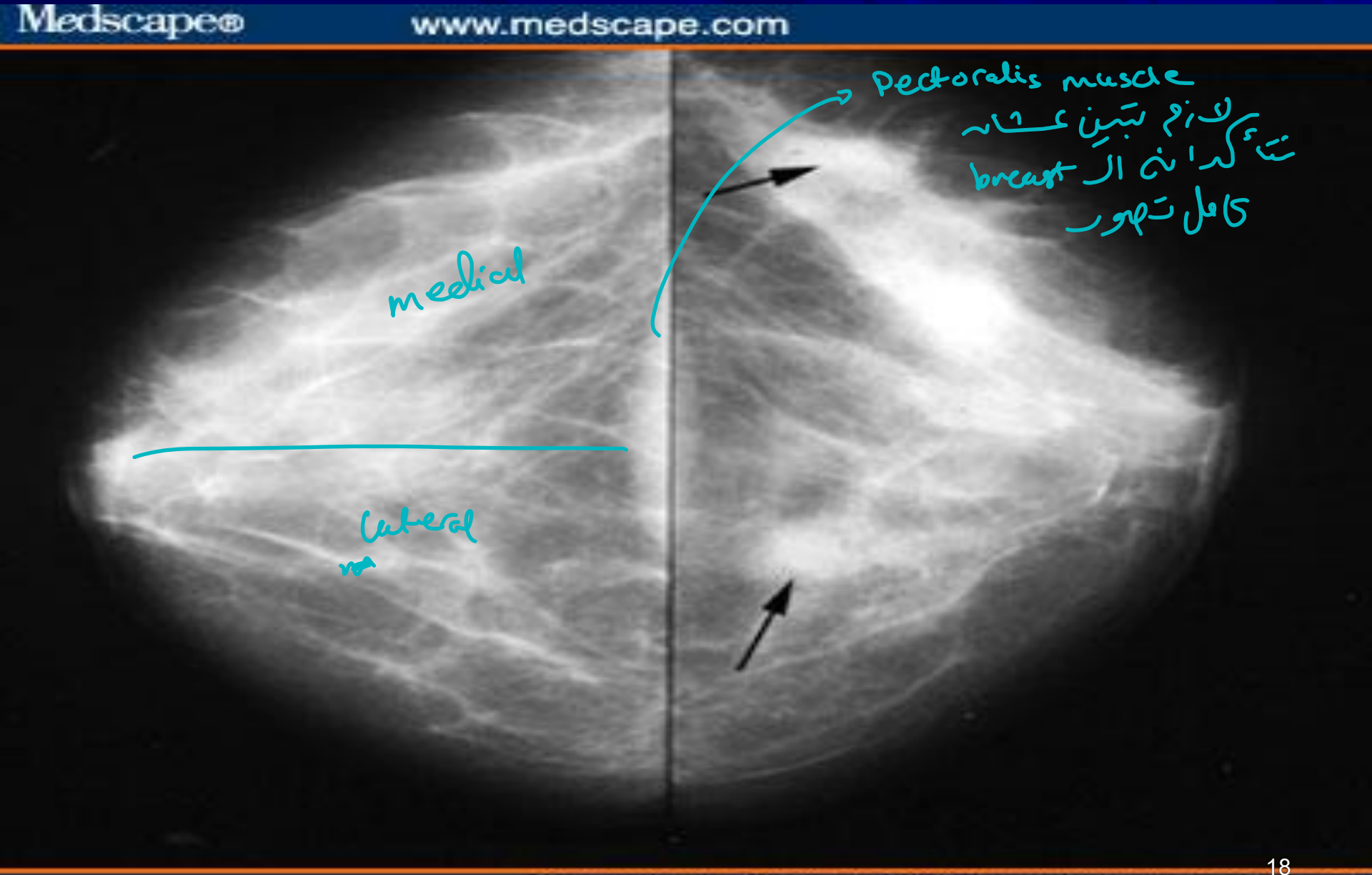
Craniocaudal view

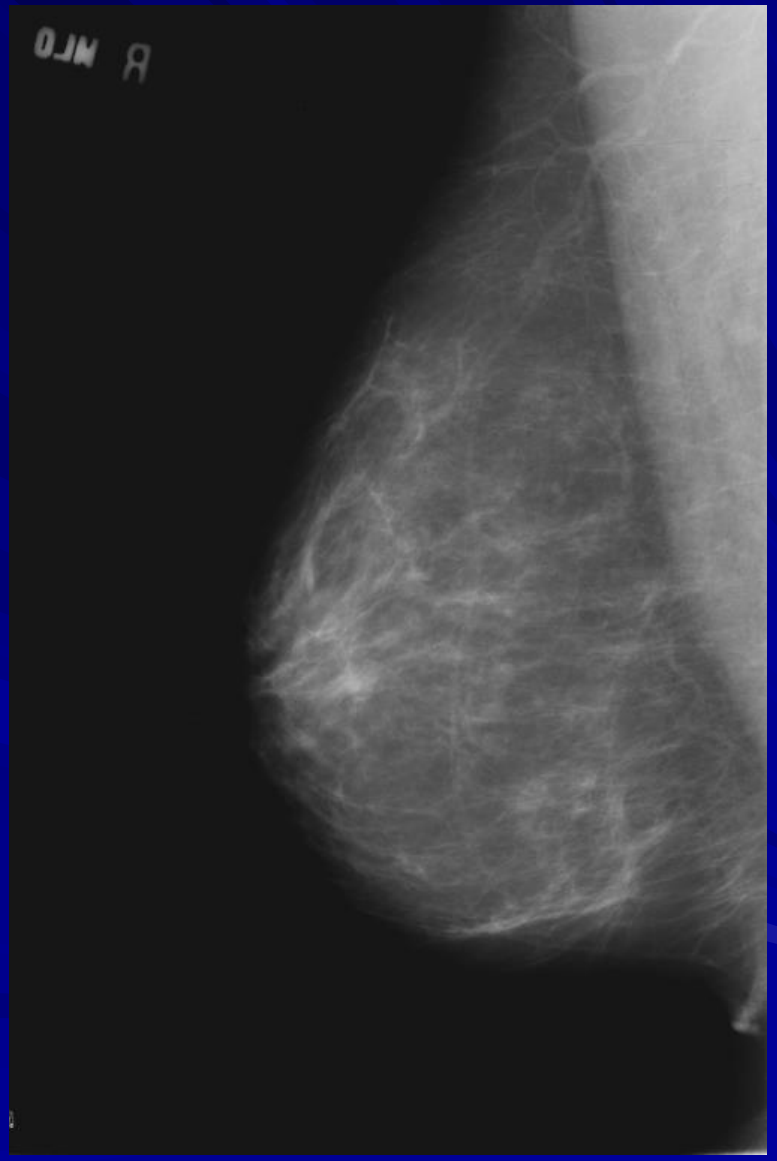
for medial or lateral location of the lesion

الأشعة من تنزل من فوق لتحت



CC

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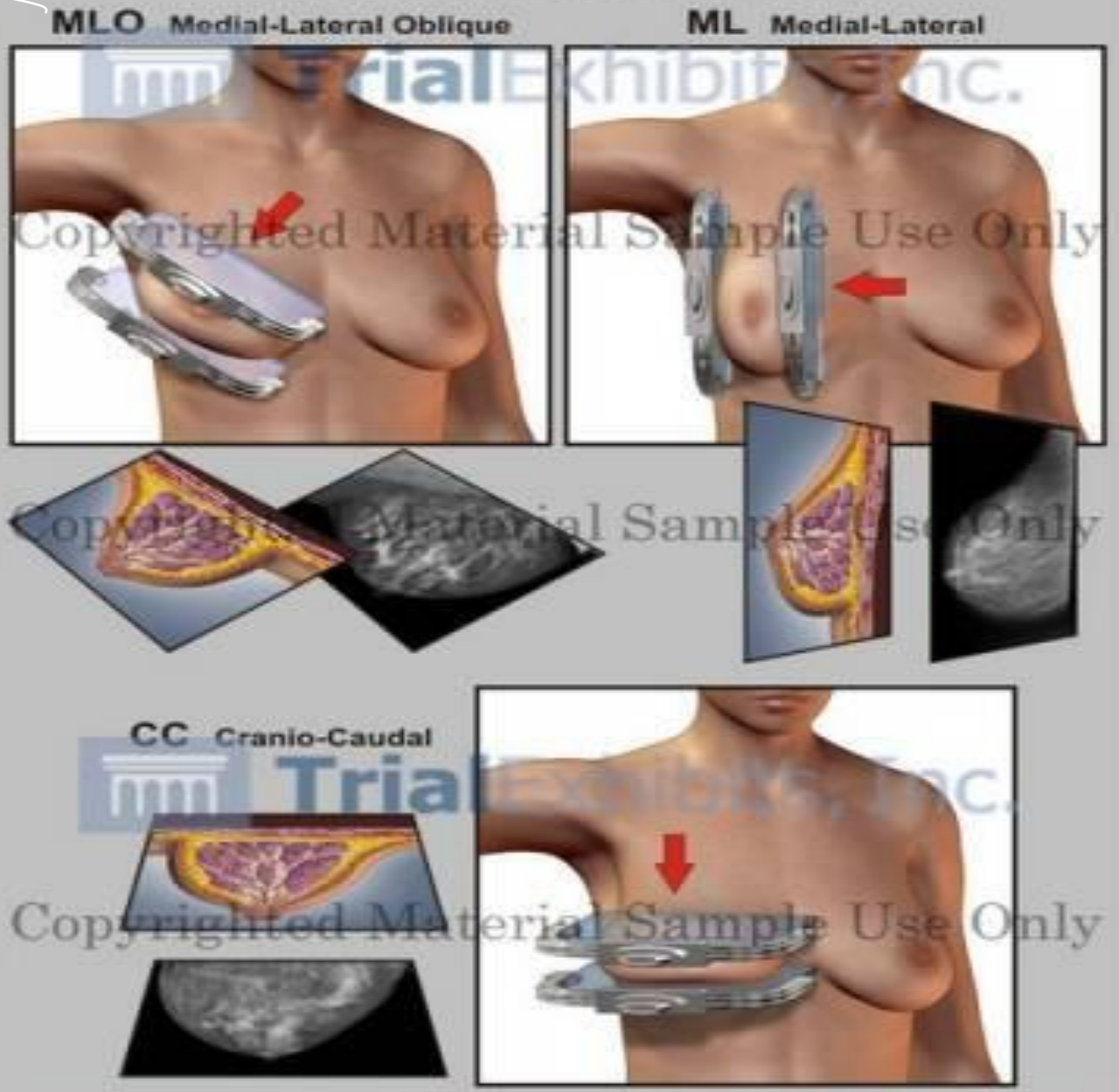
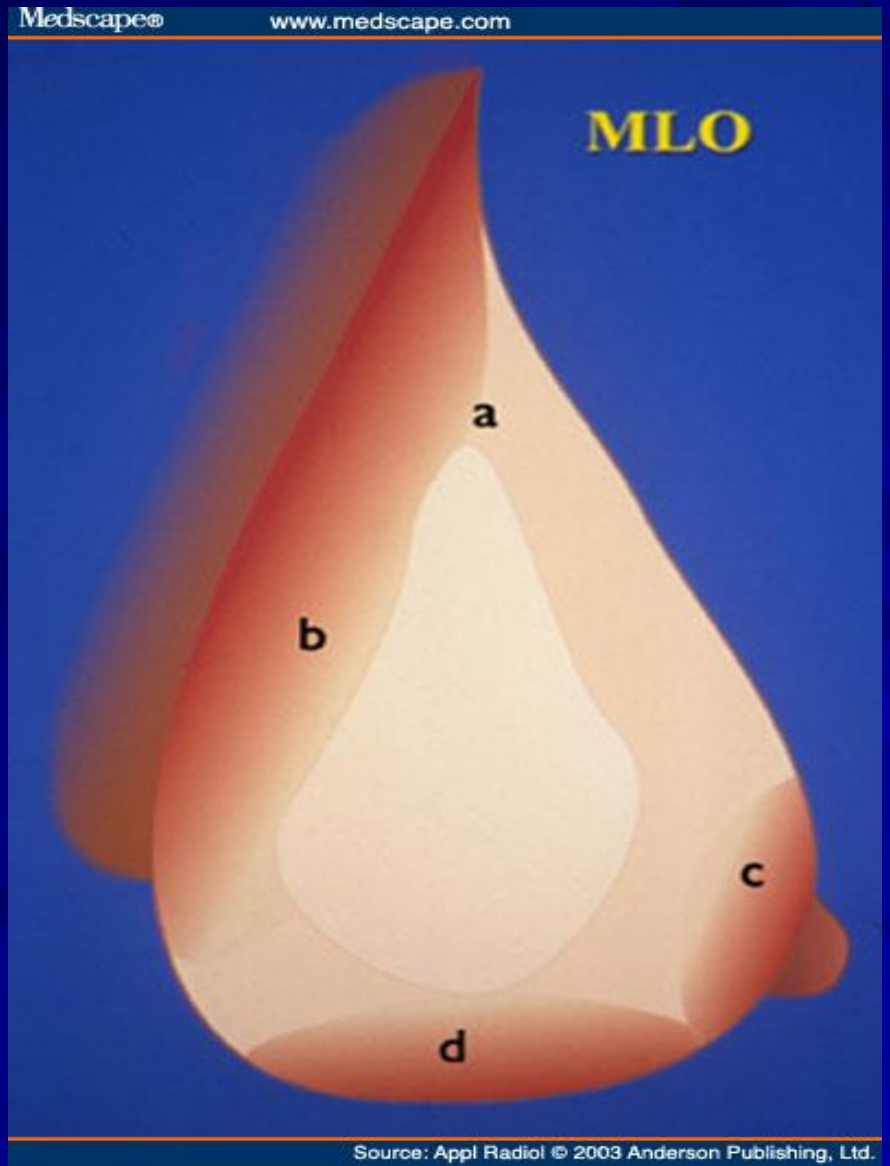
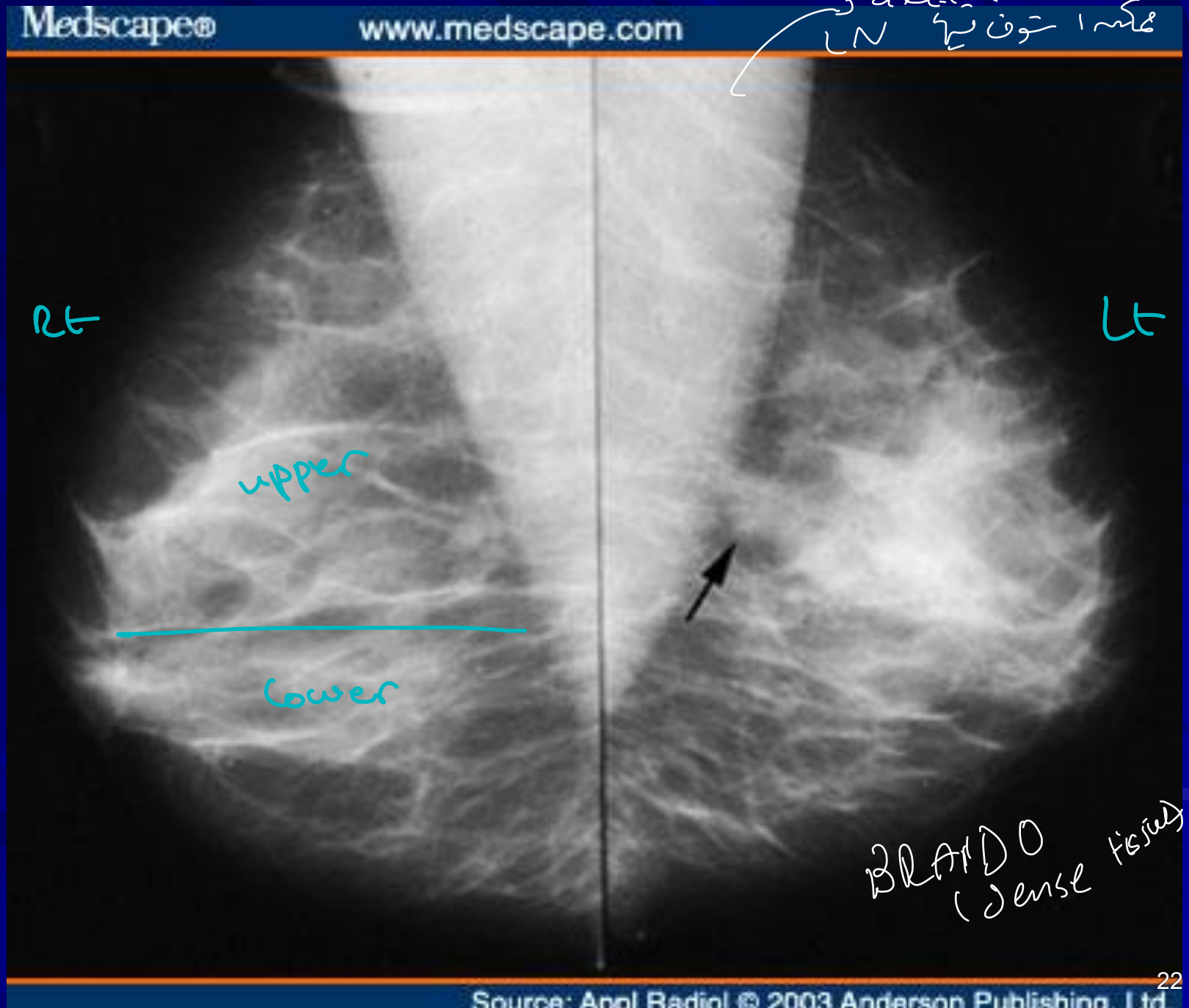
MAMMOGRAM VIEWS
OF THE RIGHT BREAST



Views of mammogram




Medscape®
www.medscape.com
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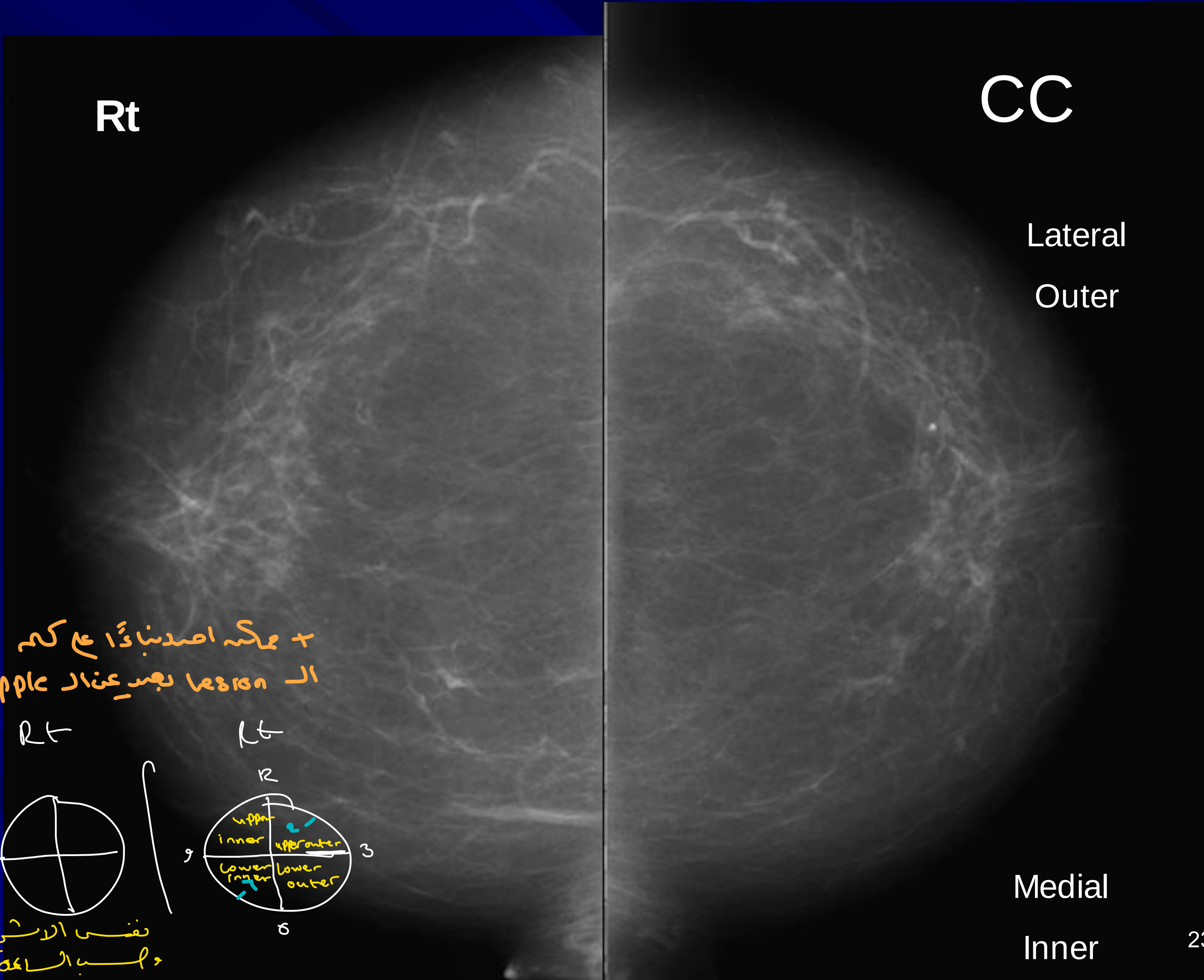
Lt
upper
lower
BRAIDO
(dense tissue)
Source: Appl Radiol © 2003 Anderson Publishing, Ltd.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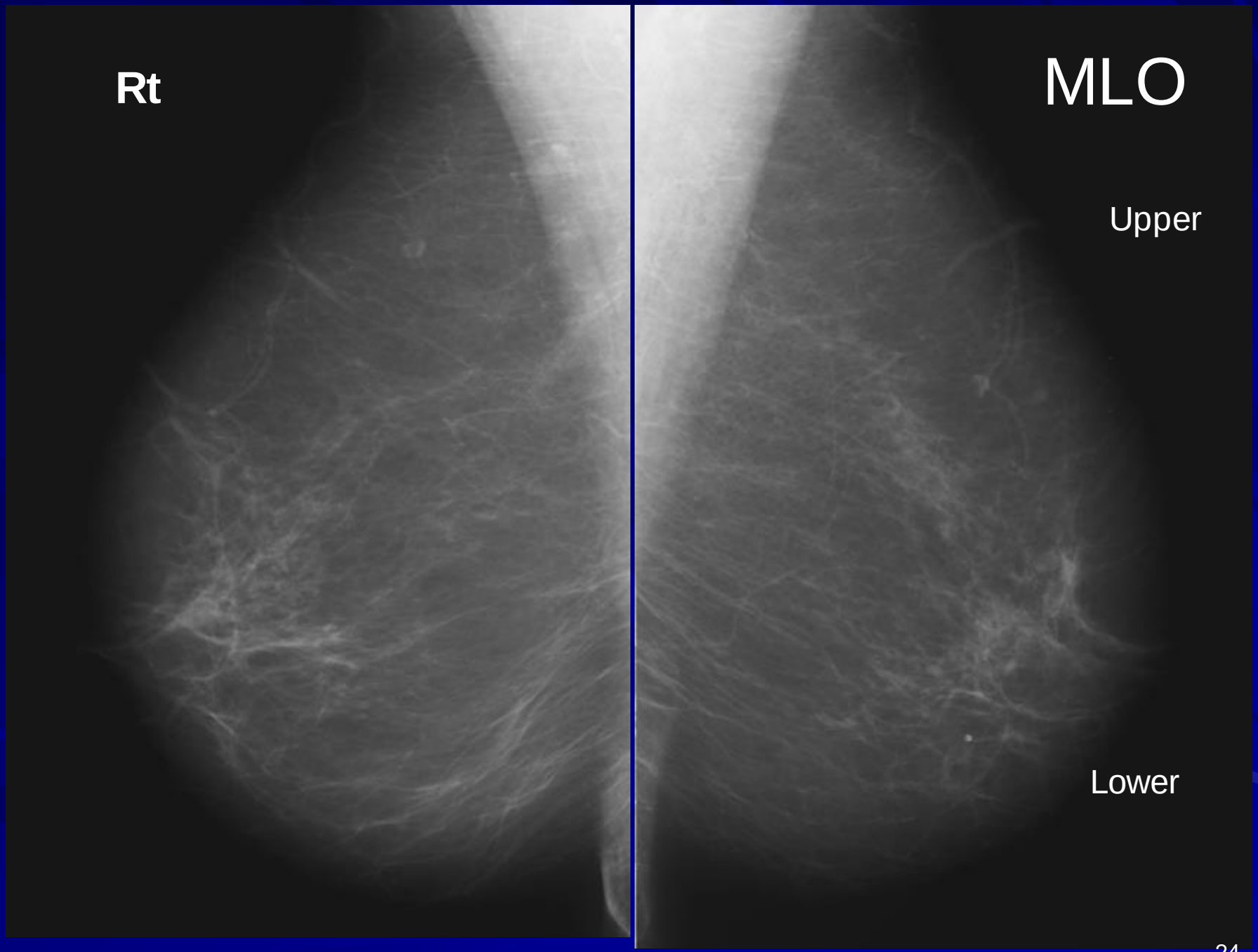
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Upper
Lower

NORMAL MAMMOGRAM

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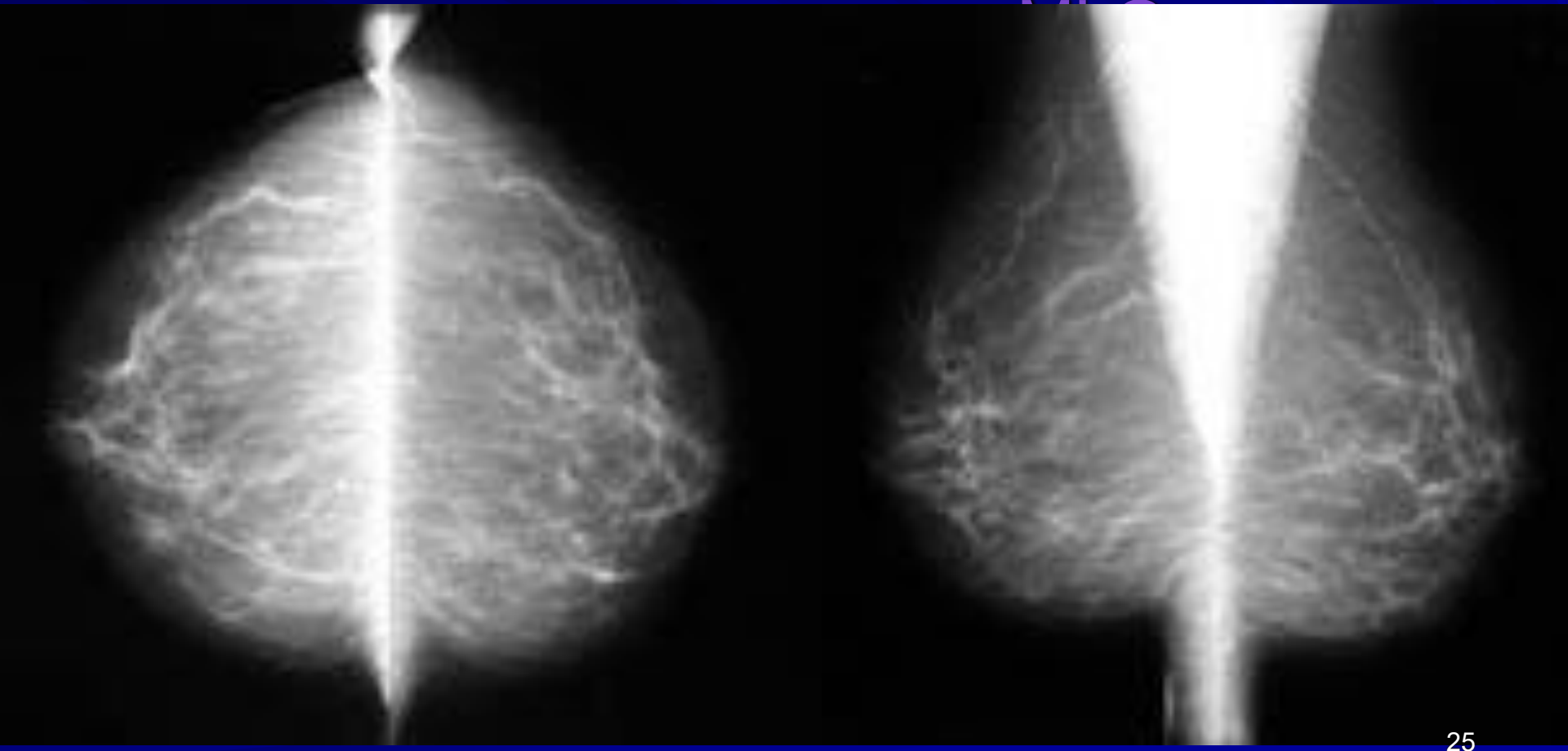

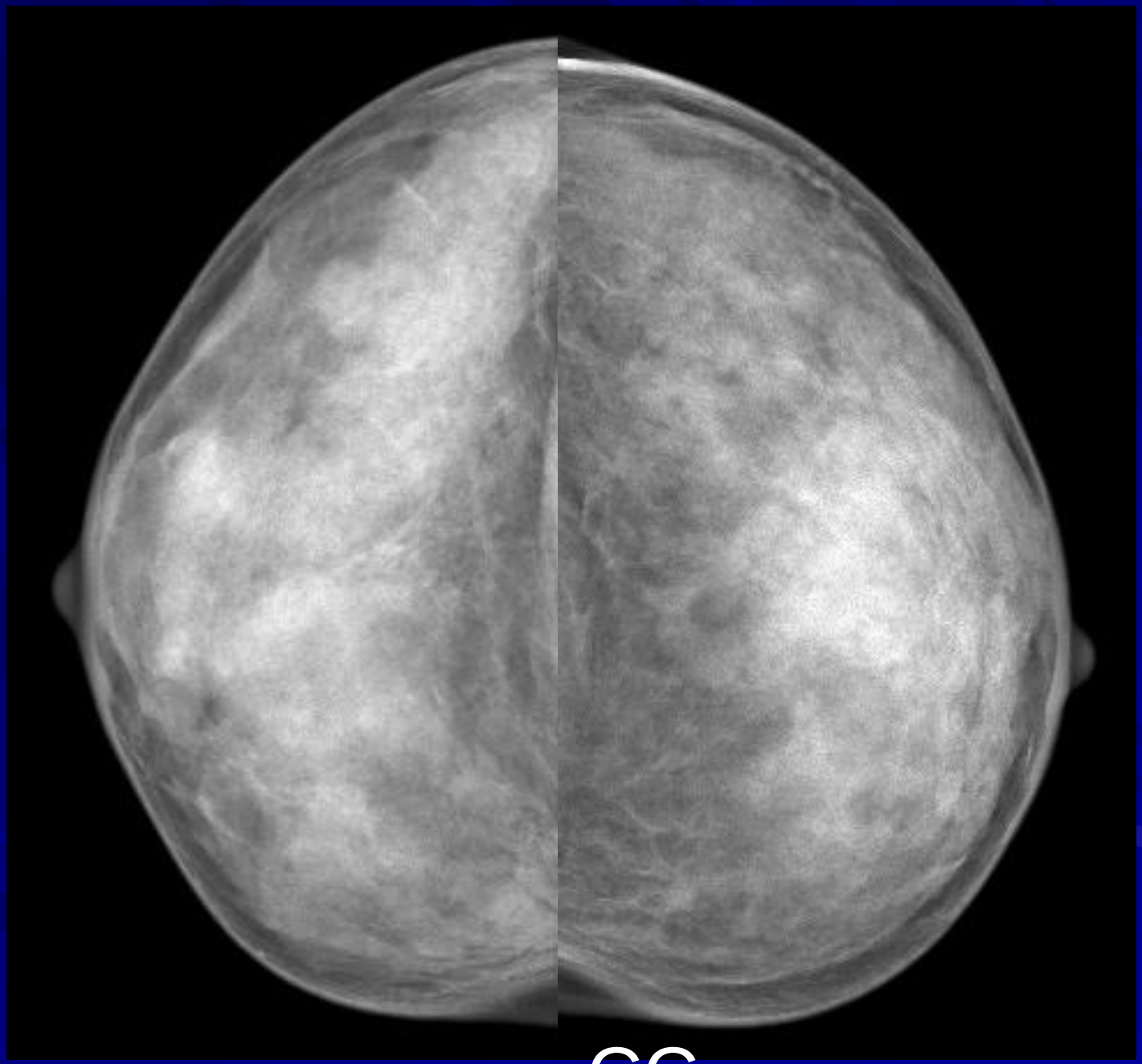

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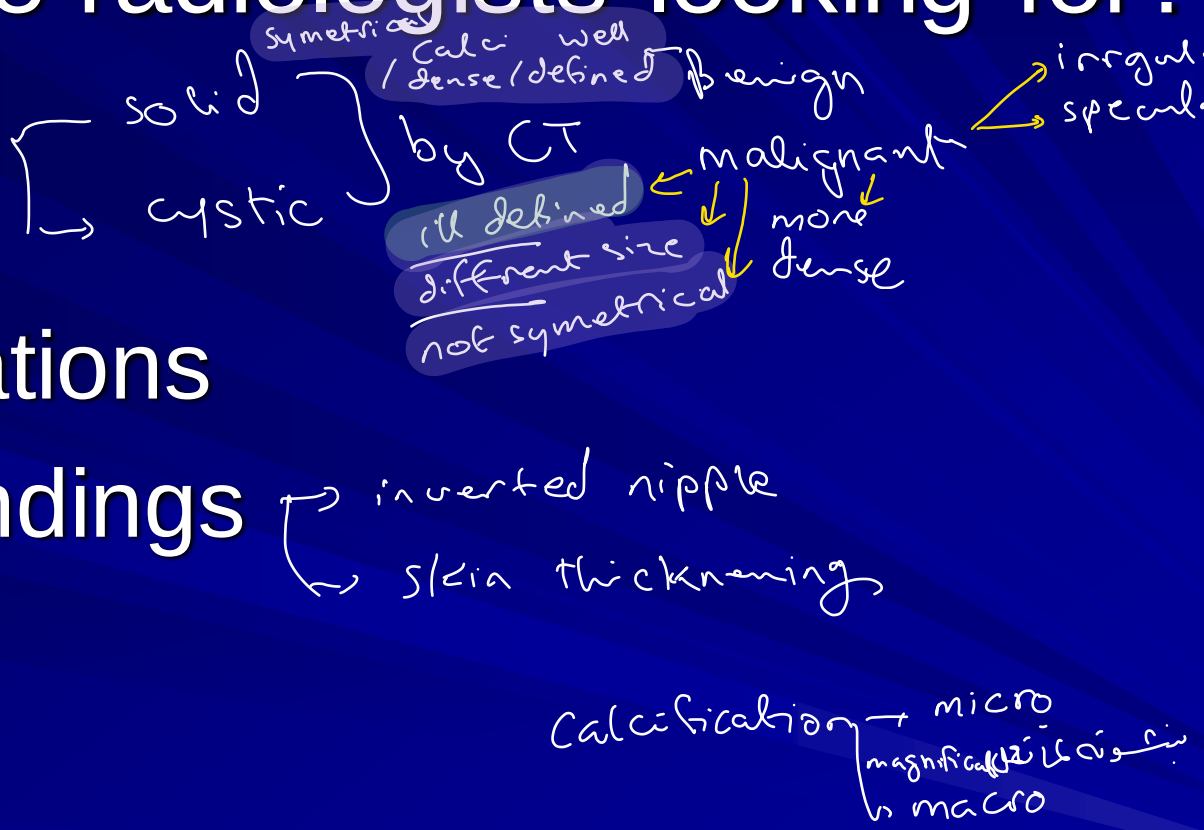
MLO

THE SCREENING MAMMOGRAM: What are radiologists looking for?

- Masses
- Calcifications
- Other findings

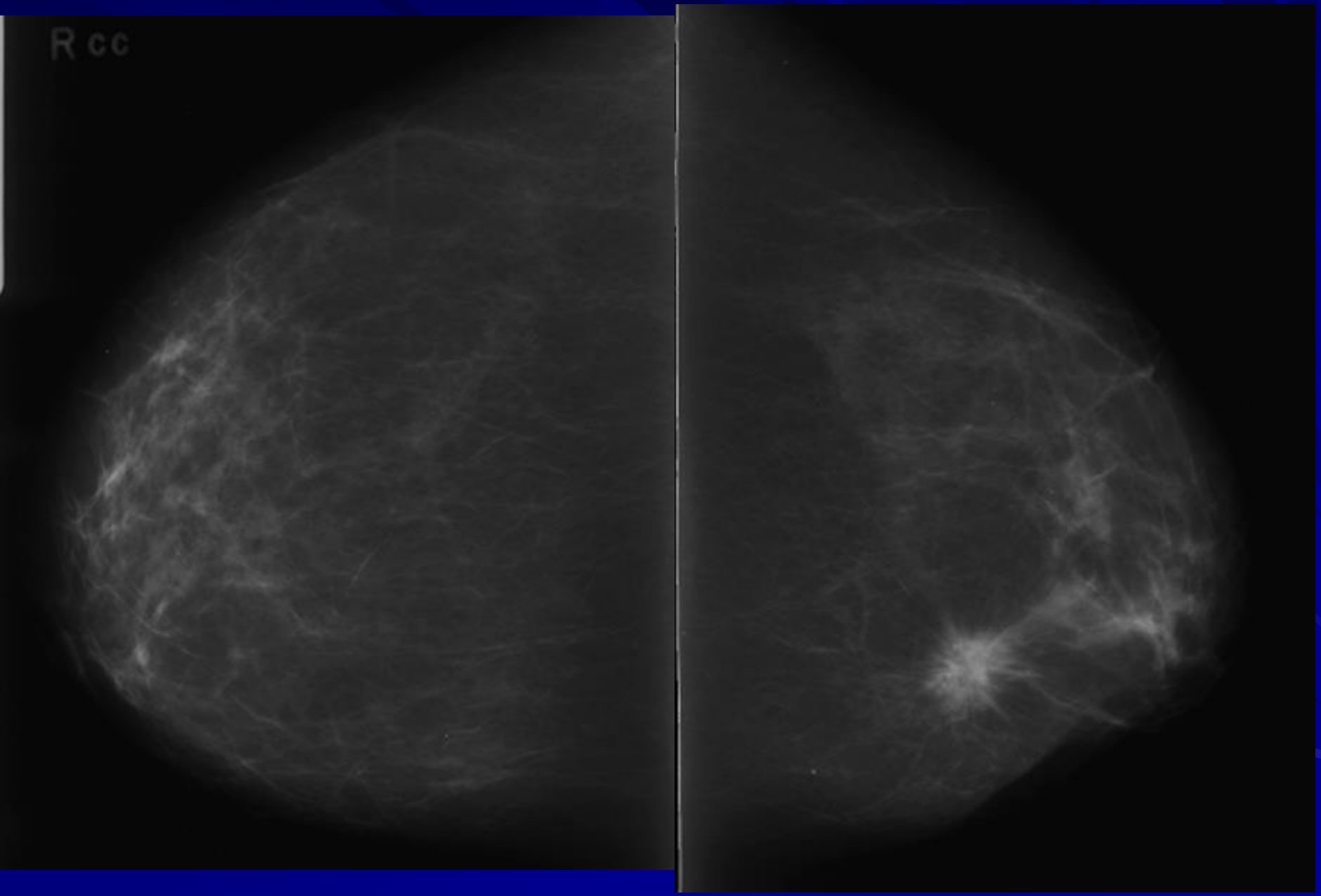


Mammography Screening: Calcifications

- Most are benign and can be dismissed
- The goal is to identify new or increasing calcifications or those with suspicious morphology

Case 1

- 55 y.o.
- Screening mammogram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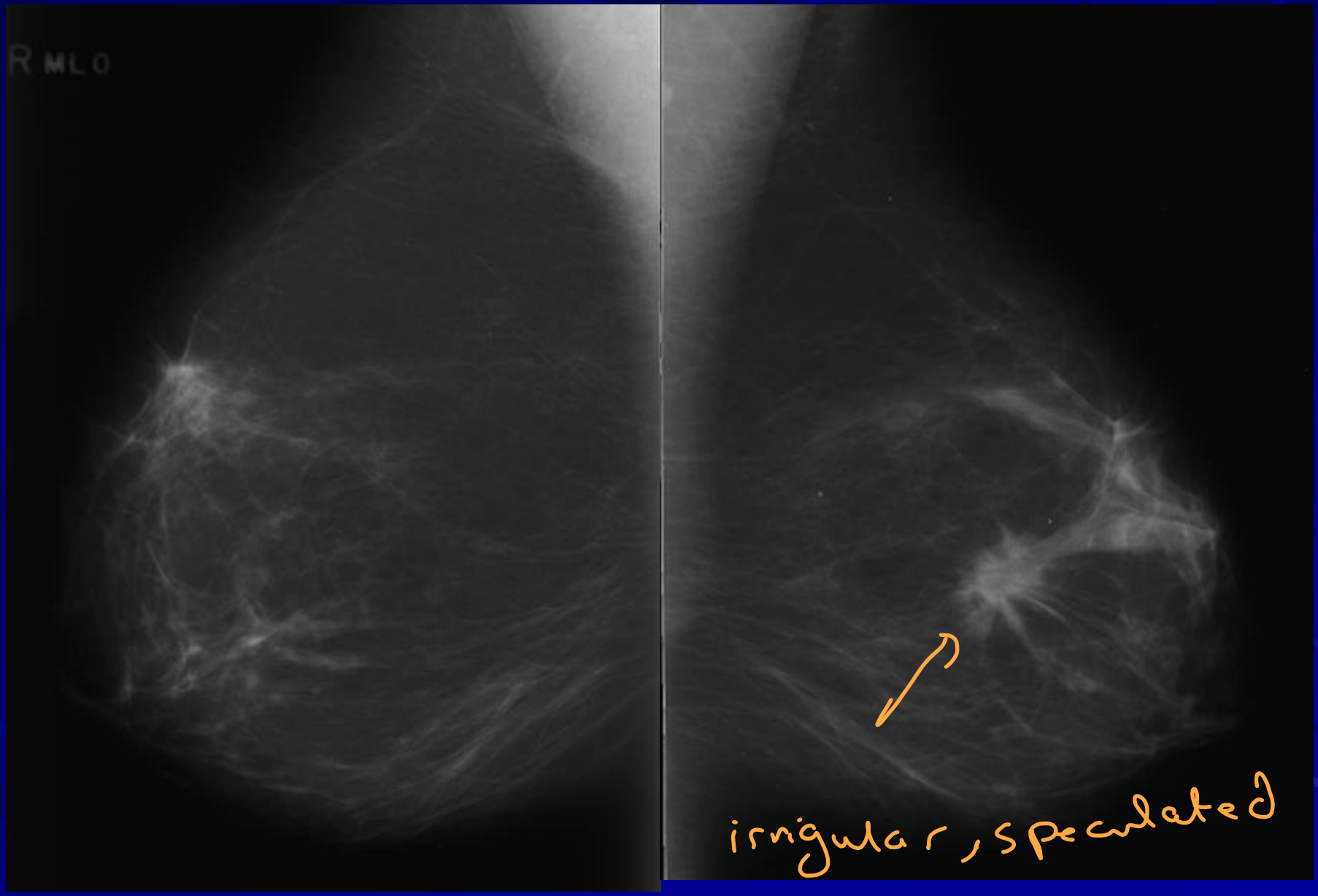
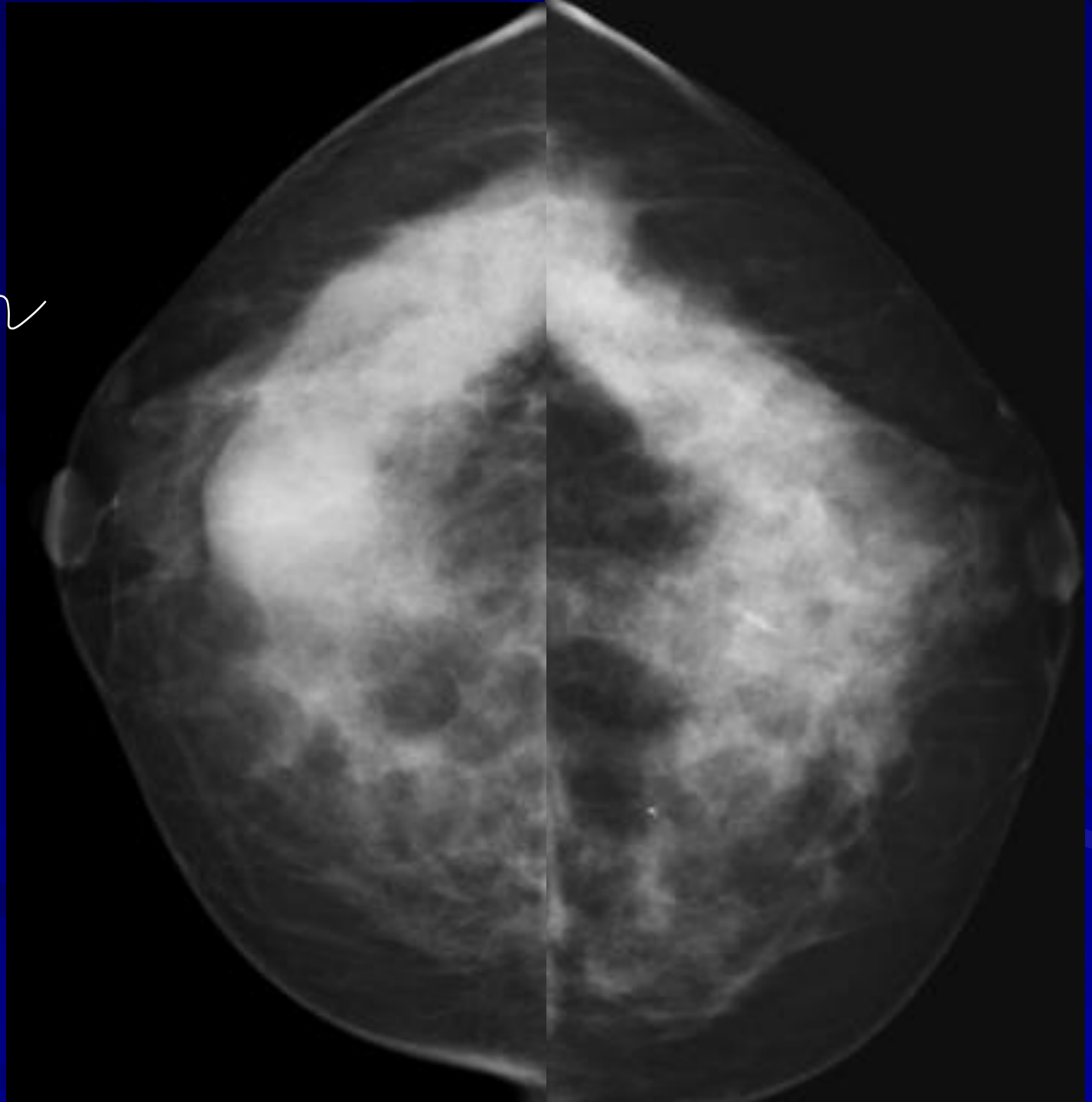


BIRAD 5

Case 2

- 47 y.o.
- Screening mammogram

BIRAD 2



Screening mammography summary

• Widely available	+
• Low cost	+
• Low risk/minimal discomfort	+
• High sensitivity and specificity/low induced cost	+/-
• Demonstrate decreased mortality	+
• High reproducibility	-

Summary: Screening Mammography

- Imperfect, but the only screening test proven to significantly decrease breast cancer deaths
- Will likely remain the primary screening test for breast cancer
- MRI may be useful in addition to mammographic screening in certain populations

ACS Screening Guidelines: Average Risk

- Annual mammography age 40 and older
  - Reduction in mortality by 30-50%
- Annual clinical breast exam age 40 and older
  - Q 3 years age 20-40
- Self breast exam optional

ACS Screening Guidelines

- Annual mammography earlier if mother or sister diagnosed with breast cancer (10 years prior to age of relative's diagnosis)
- MRI if at high risk for breast cancer

SCREENING VS DIAGNOSTIC MAMMOGRAPHY

- Diagnostic mammography
  - Patients with breast signs or symptoms (palp lump, pain, nipple d/c)
  - Important for breast signs or symptoms that clinicians specify
    - Location (side, clock-face, distance from nipple)
    - Size and shape
    - Diagram

DIAGNOSTIC MAMMOGRAPHY

- Asymptomatic patients with abnormality detected on screening mammogram (“recalled”)
- Performed under the supervision of a radiologist
- Additional specialized mammographic views
  - Spot compression +/- magnification

VIEWS OF DIAGNOSTIC MAMMOGRAM

- Main views:

1- Mediolateral oblique.

2- Craniocaudal.

- Additional views:

1- Compression view for areas of suspicious masses or asymmetric breast tissue.

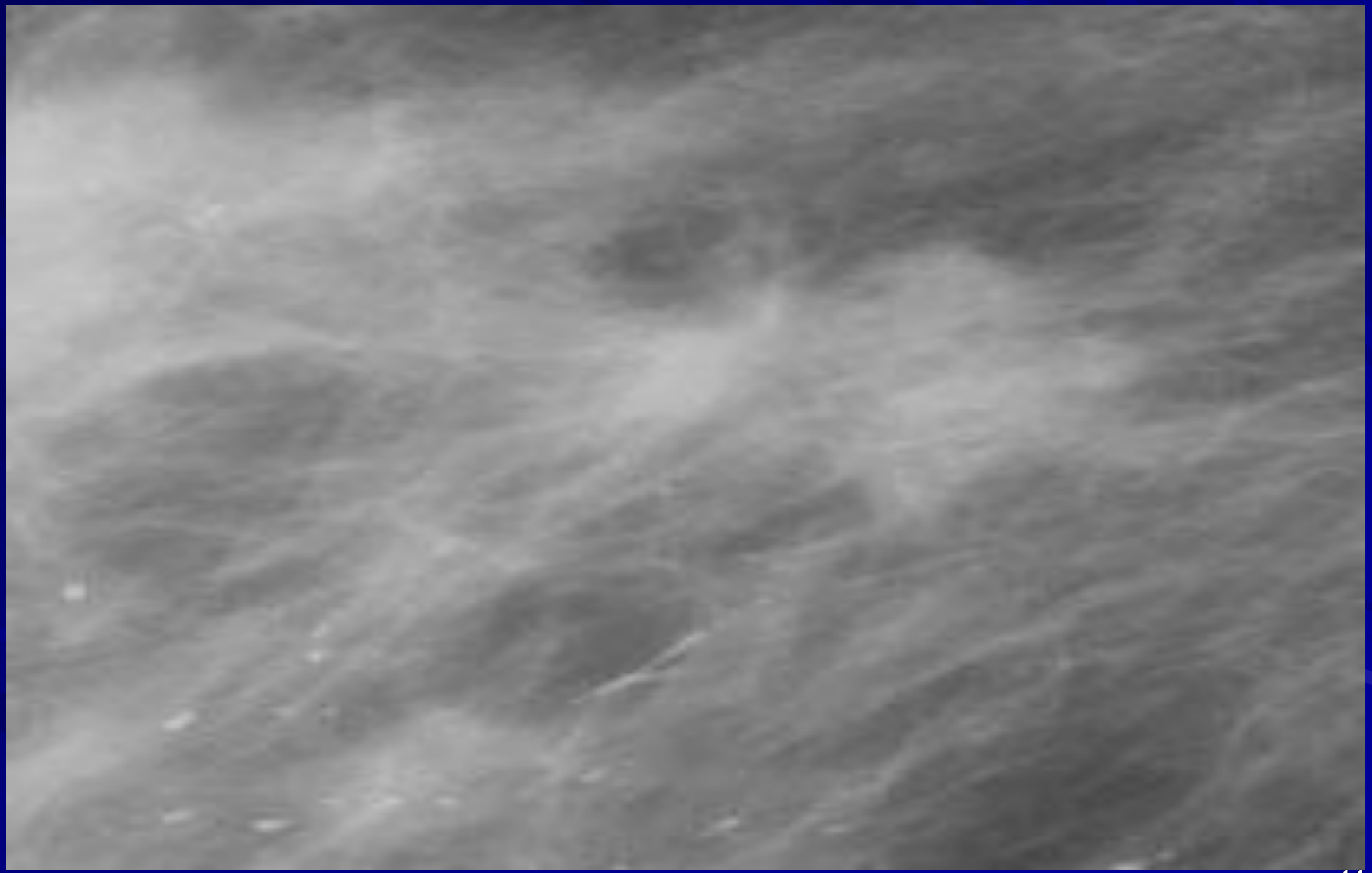
2- Magnification view for suspicious calcifications.

Compression view

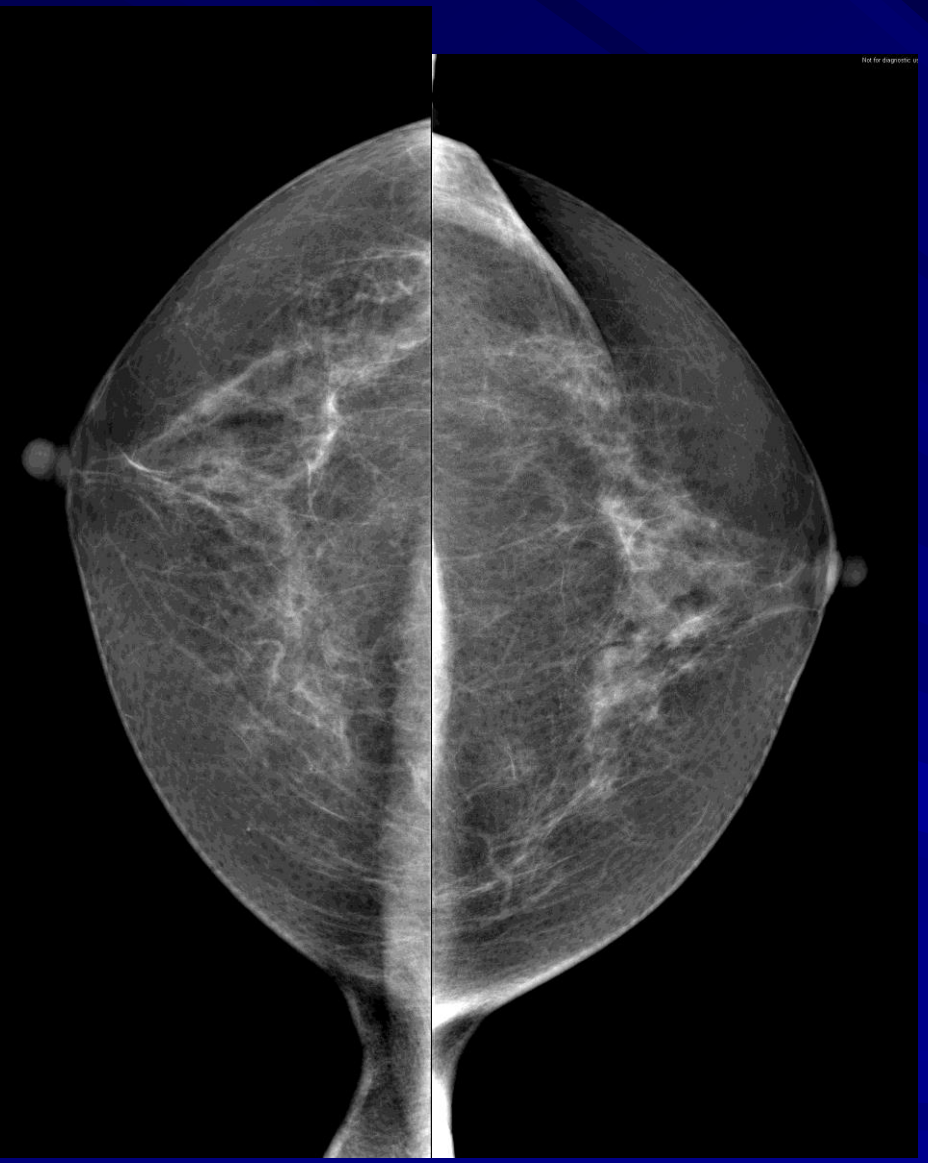
spot magnified compression view

Magnification

BIRADS 5



Case 1: Patient Recalled From Screening

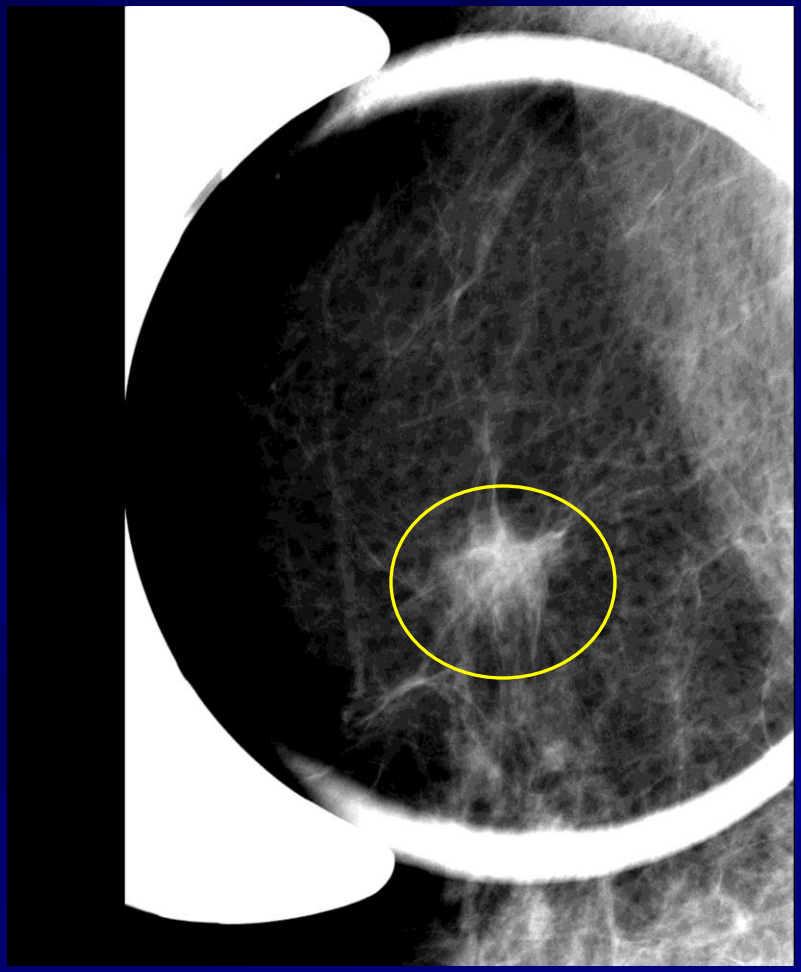


Screening Mammogram

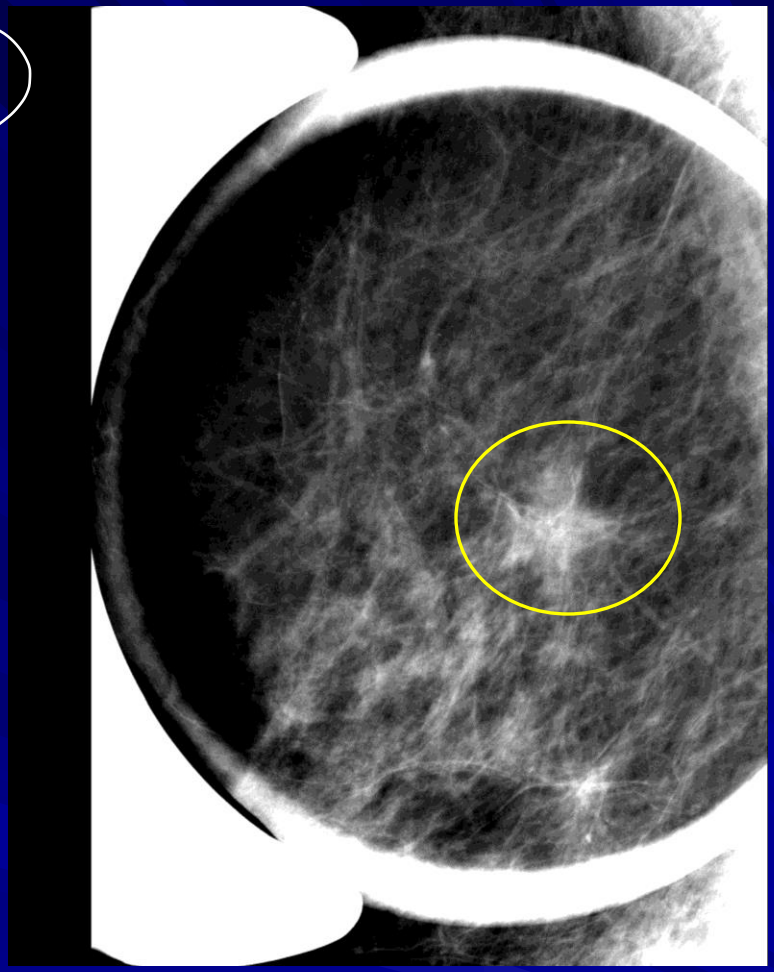
BIRAD 5_

Diagnostic Mammography Work-up: Screening Recall

- Is the finding real?
  - Spot Compression Magnification
- Localize in two dimensions
- Is the finding suspicious for malignancy
  - Feature analysis
- What Next?



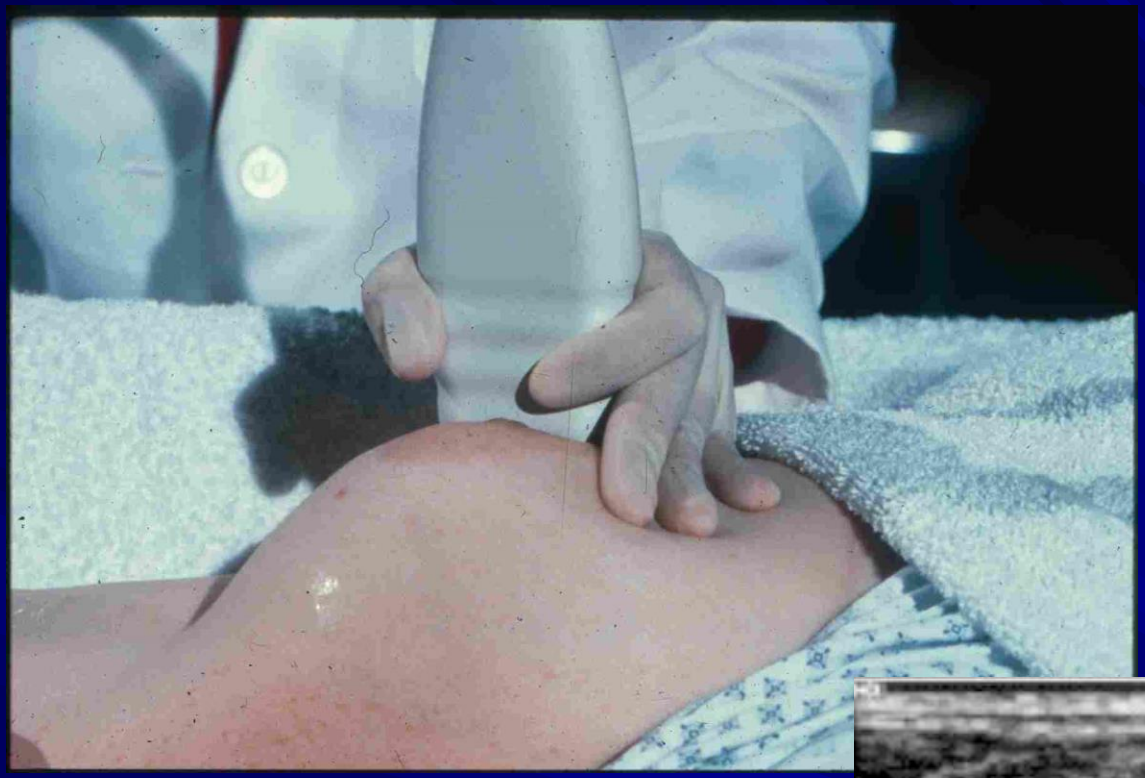
Spot Compression Mag
True Lateral

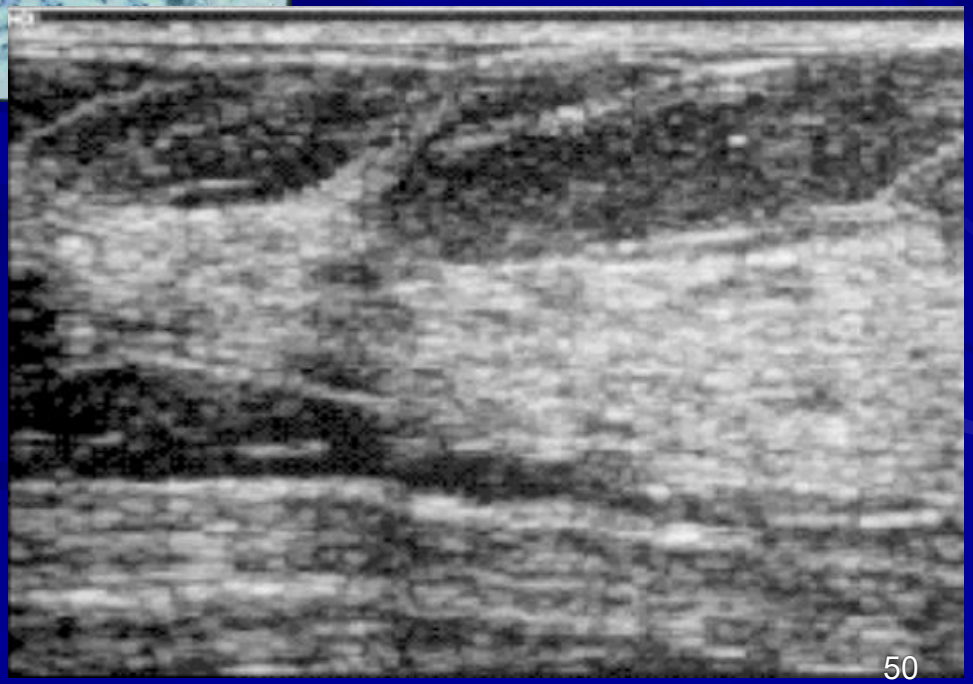


Spot Compression Mag
MLO

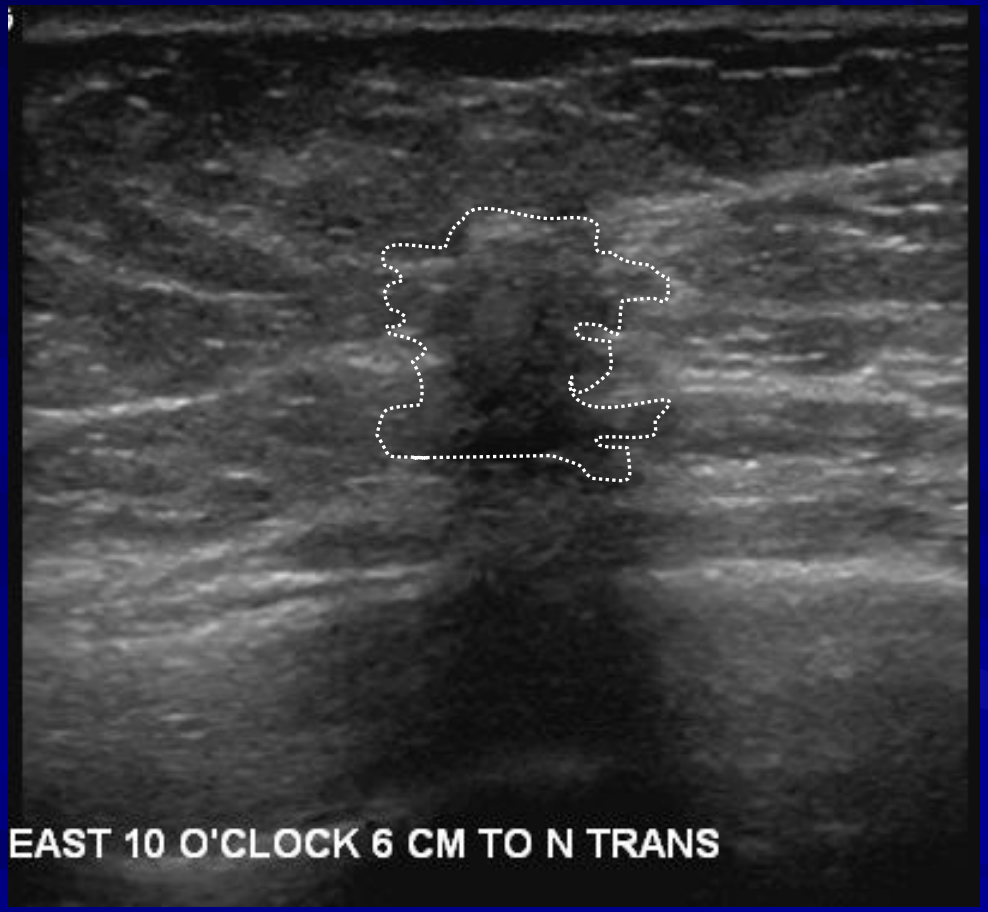
Breast Ultrasound: Indications and Imaging Role

- Mammographically detected masses
- Palpable masses after mammography (most)
- Initial study for palpable masses
  - Pregnant
  - Lactating
  - Less than age 30
- Cyst versus solid
- Solid masses: benign versus malignant features



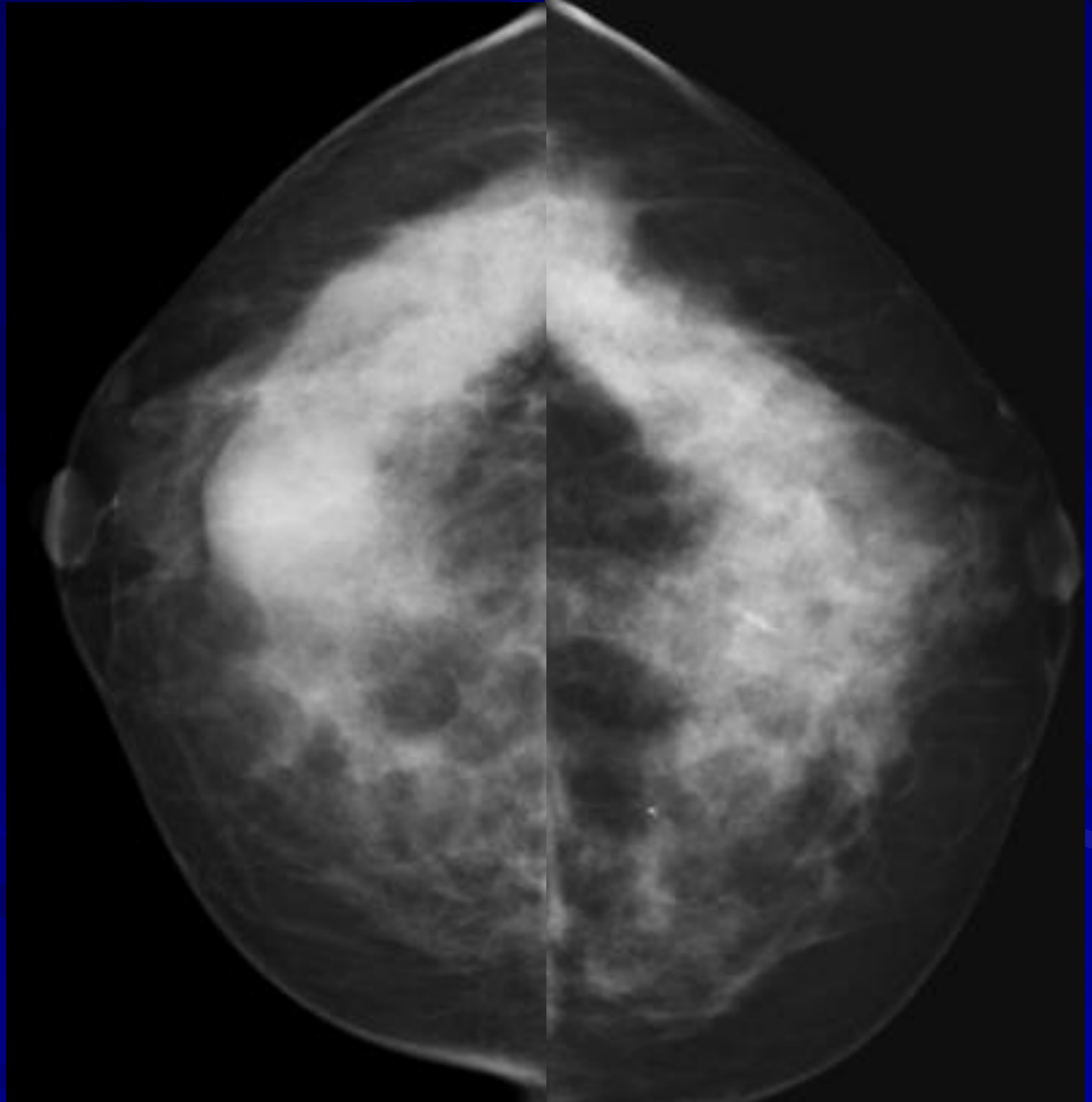


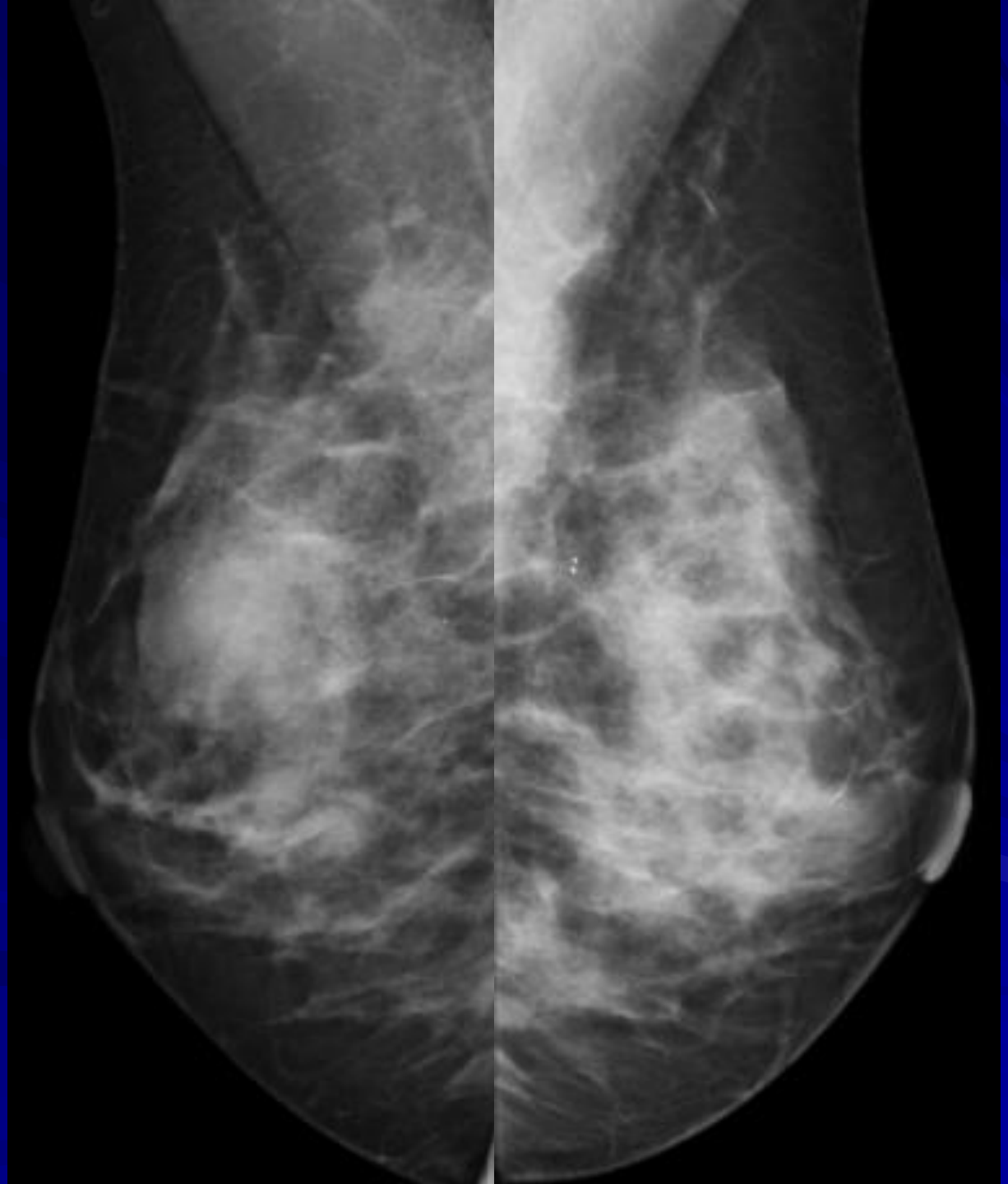
Case 1
Directed Breast Ultrasound



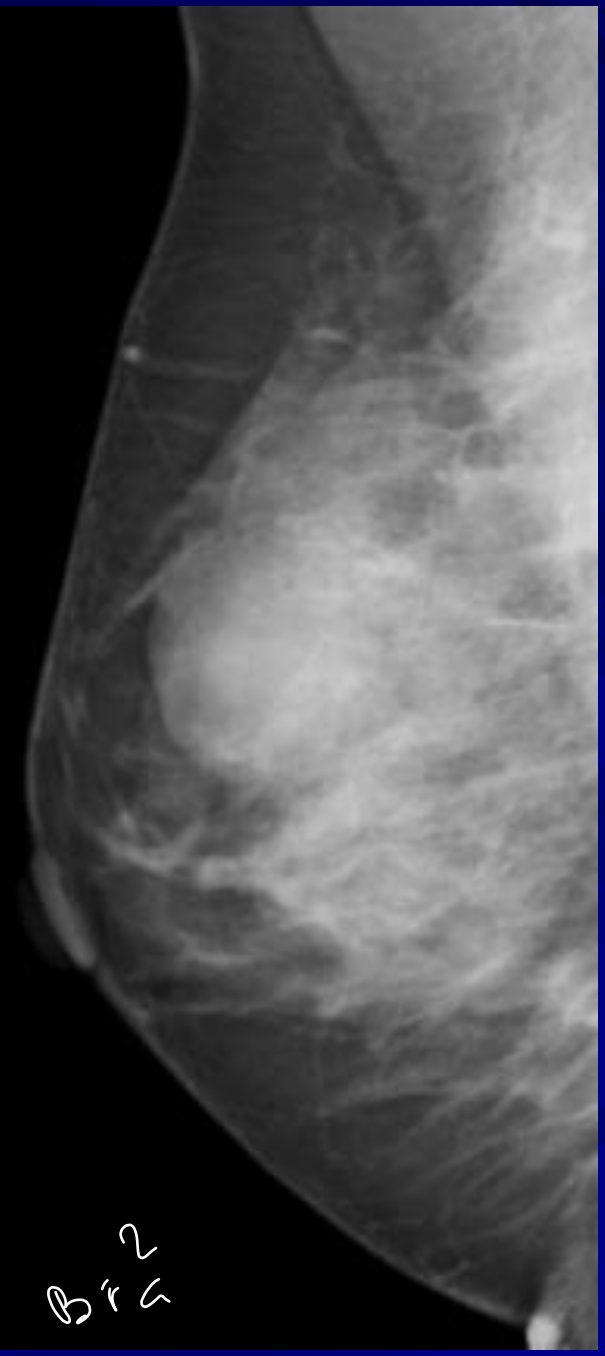
Irregular Solid Mass

Comparison Case 2: Patient Recalled From Screening





well defined
regular
mass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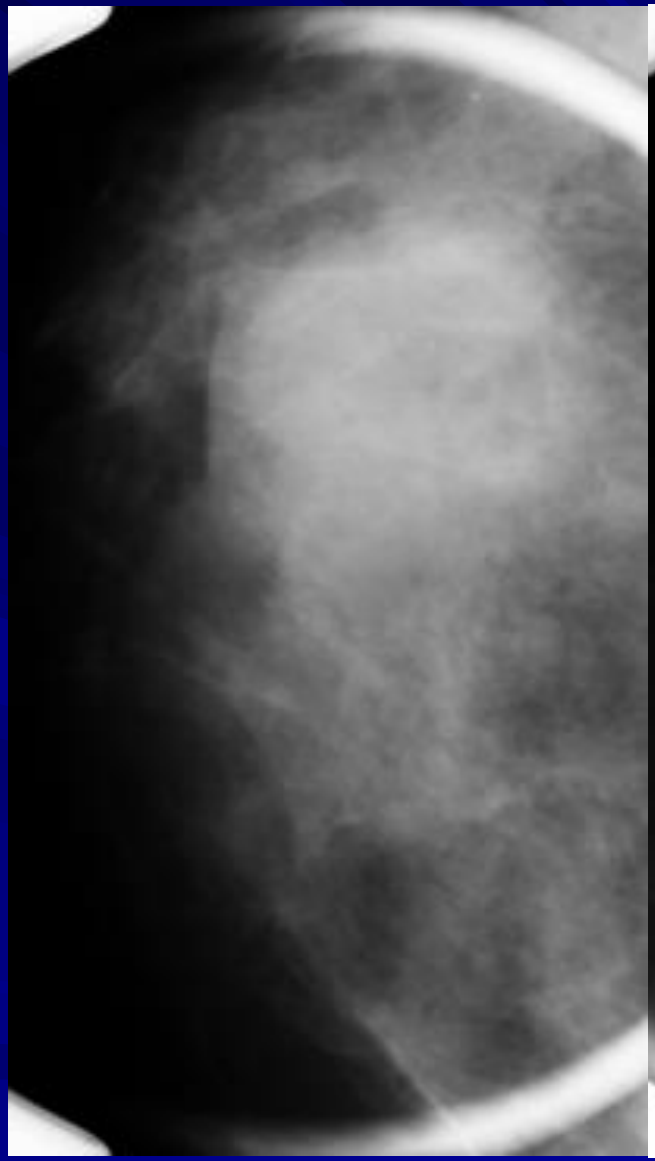
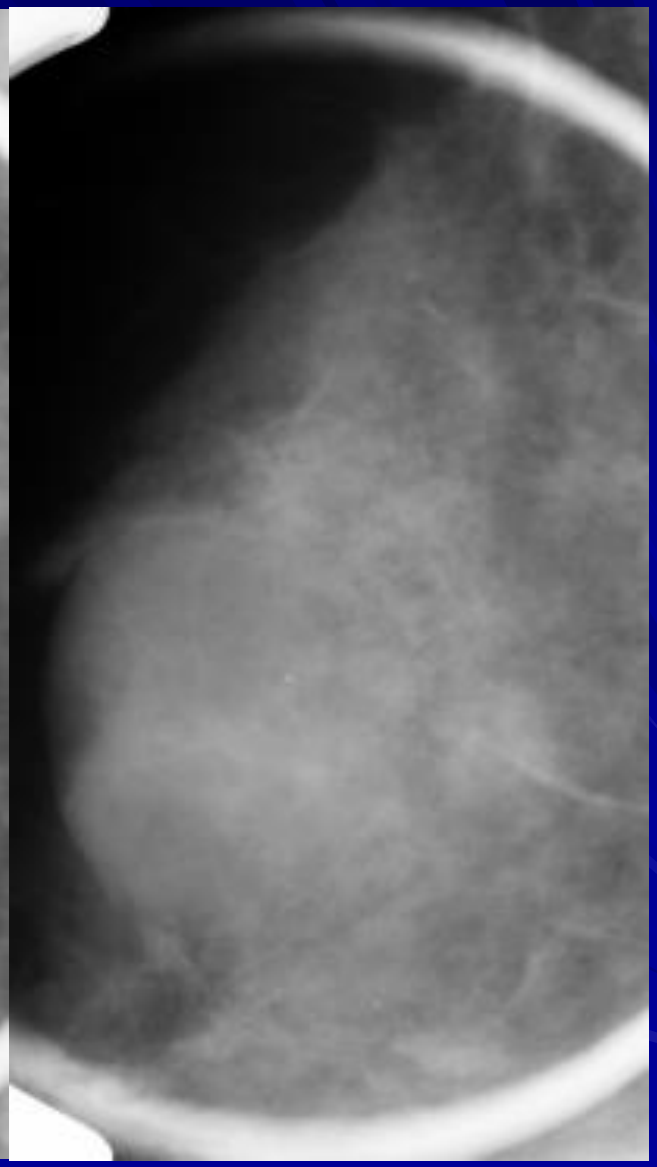
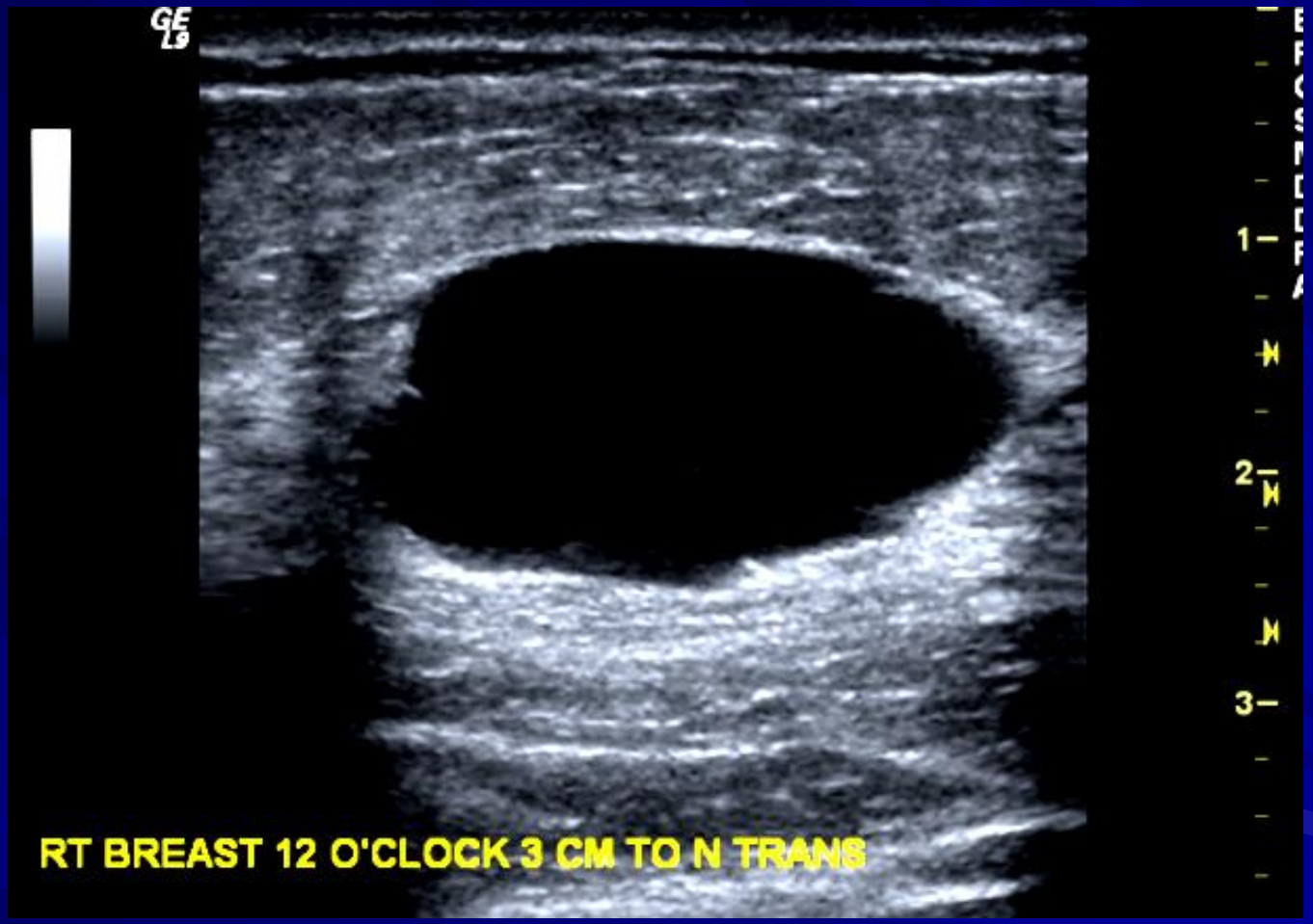






Simple Cyst (fluid inside)

Mammographic signs of benign breast lesions

- **Benign** masses tend to be spherical with smooth borders & if they contain calcifications , it is coarser(macro) & more structured-punctate or round & are of similar density than that seen in carcinoma .

a translucent center of calcification is also a sign

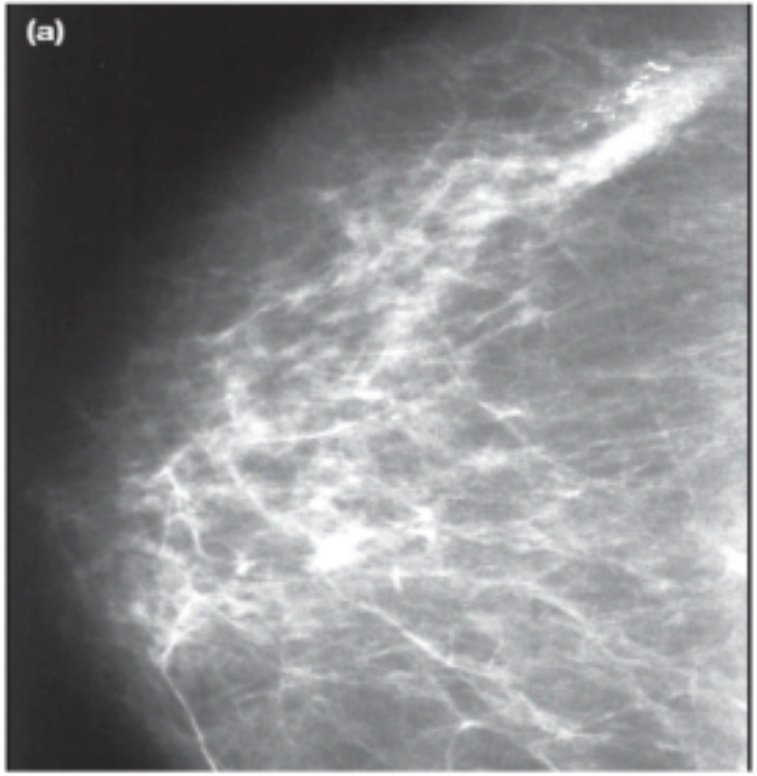
Mammographic signs of malignant breast lesions

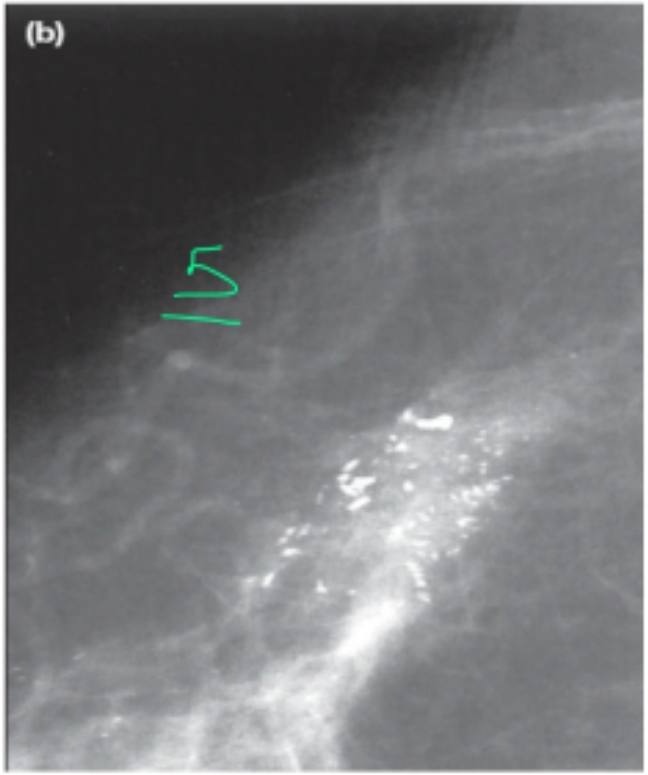
- ***Malignant*** *lesions tend to be of variable shape, irregular outline ,calcification (the so called malignant microcalcification-calcification : different particle shape, density& the cluster shape is irregular or triangular pointing toward the nipple).*

Warning Mammographic Signs of Breast Cancer

- Clustered calcifications, microcalcifications
- Spiculated mass (spiky lump) .
- Assymetrical density of breast tissue.
- Skin thickening .
- Retraction (skin or nipple pulling inwards) .
- Focal distortion (something is pressing on tissue) .

- Microcalcifications are an important sign of early breast cancer ,they are the dominant abnormality in 90% of in situ carcinomas.
- Technical advances in mammography equipment have lead to significant improvement in mammographic image quality and changed the ability to detect early breast carcinoma.





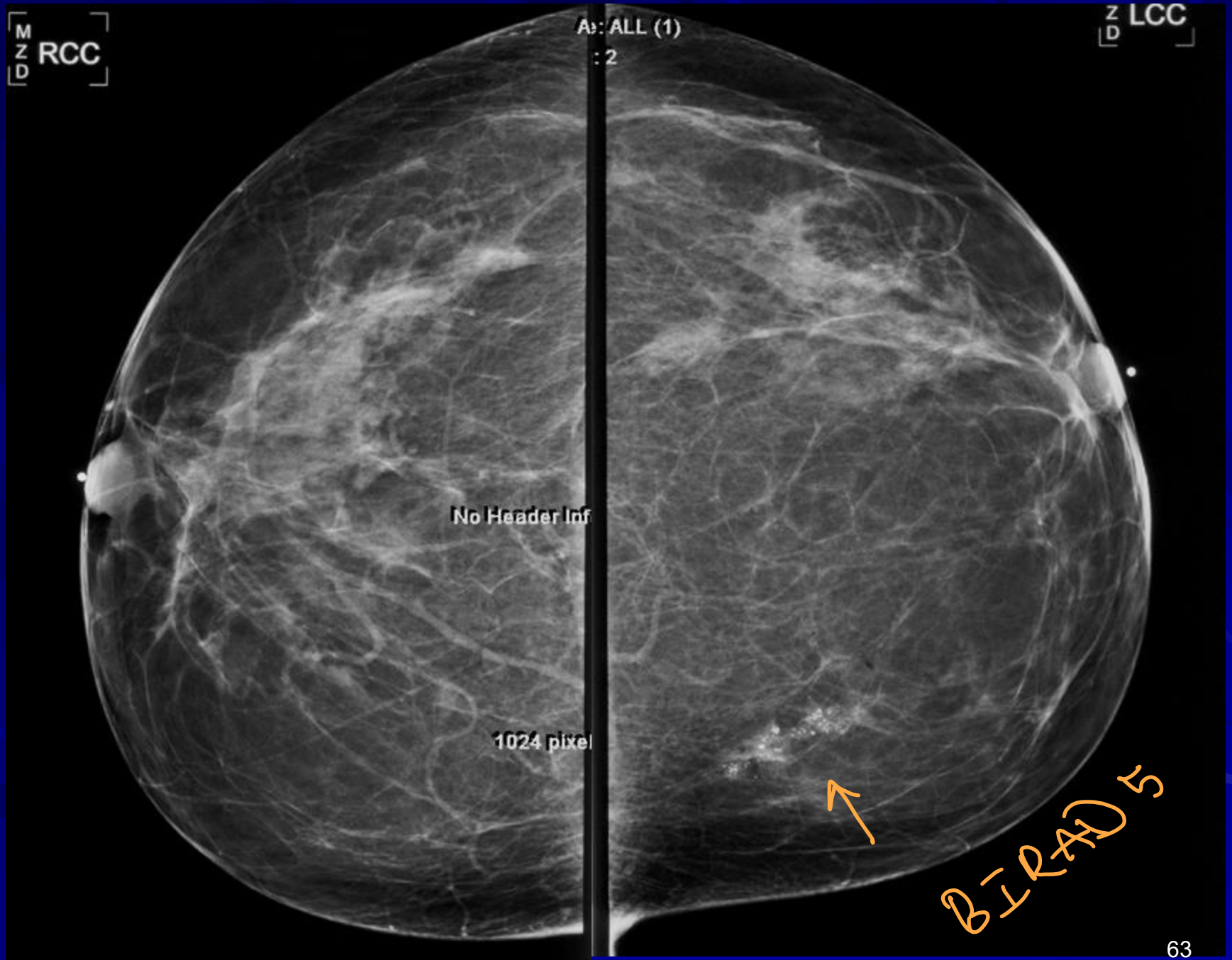
Routine craniocaudal mammogram clustered of microcalcifications

spot-magnification mammogram. Shows better details

Histology revealed ductal carcinoma in situ

Routine craniocaudal mammogram.
clustered of microca
Histolog

Case 3: Suspicious Calcifications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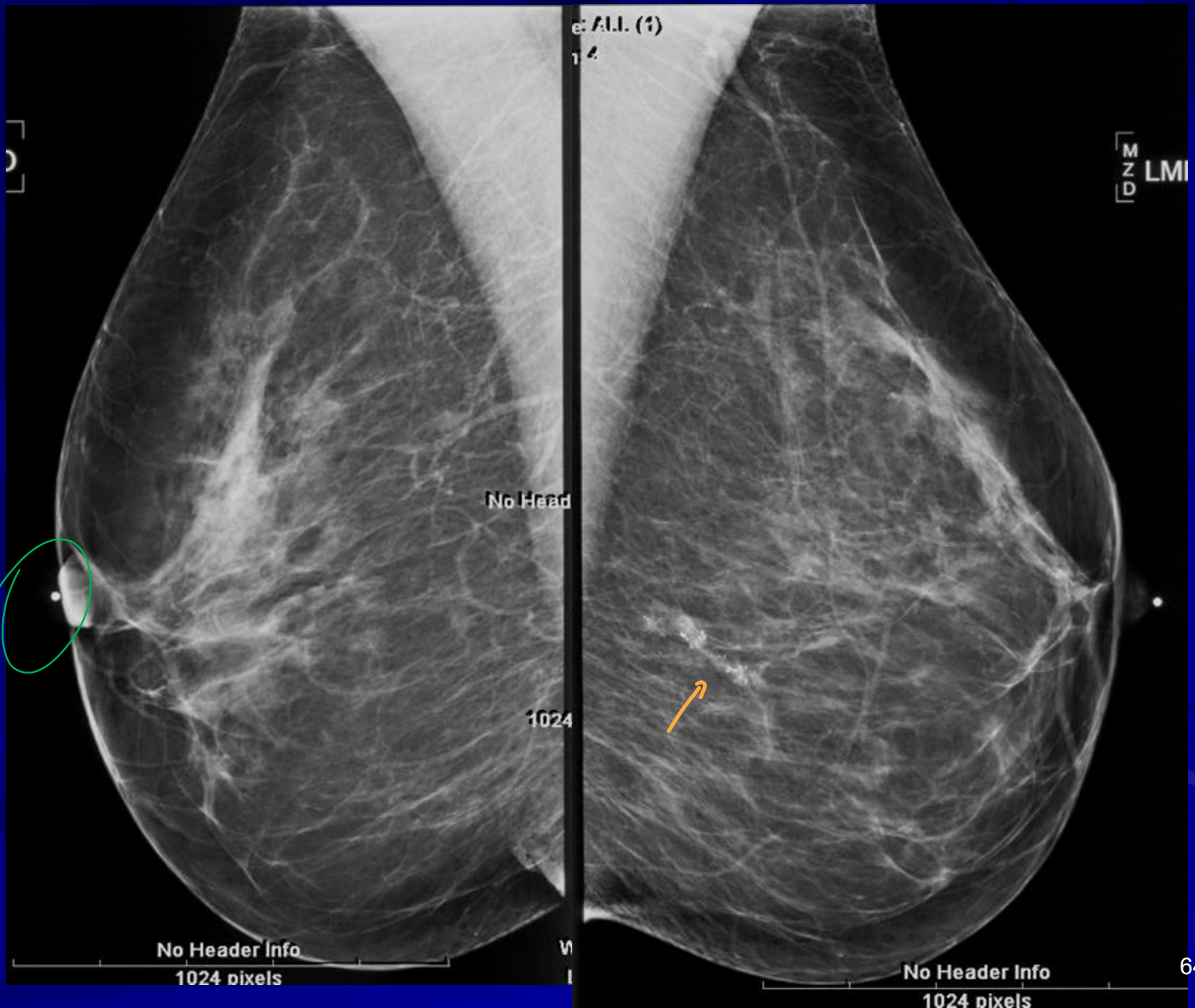
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clustered malignanted ill defined

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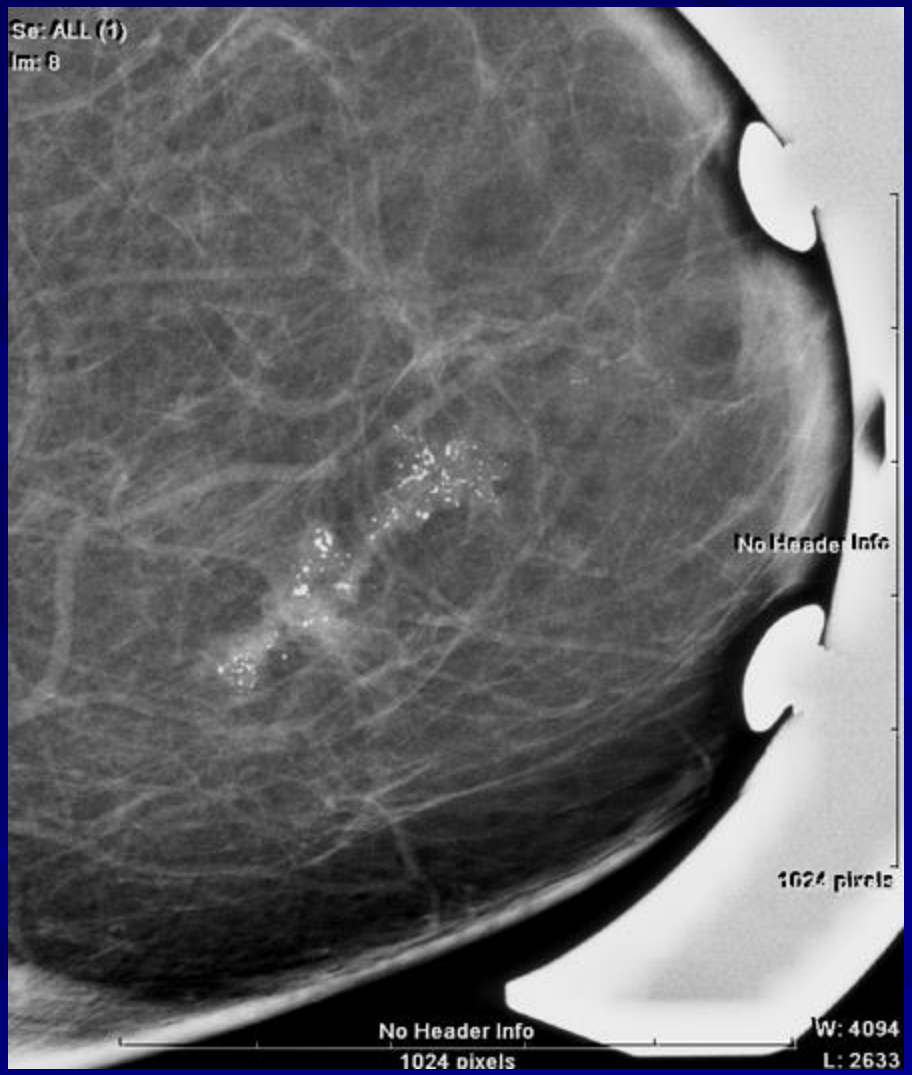
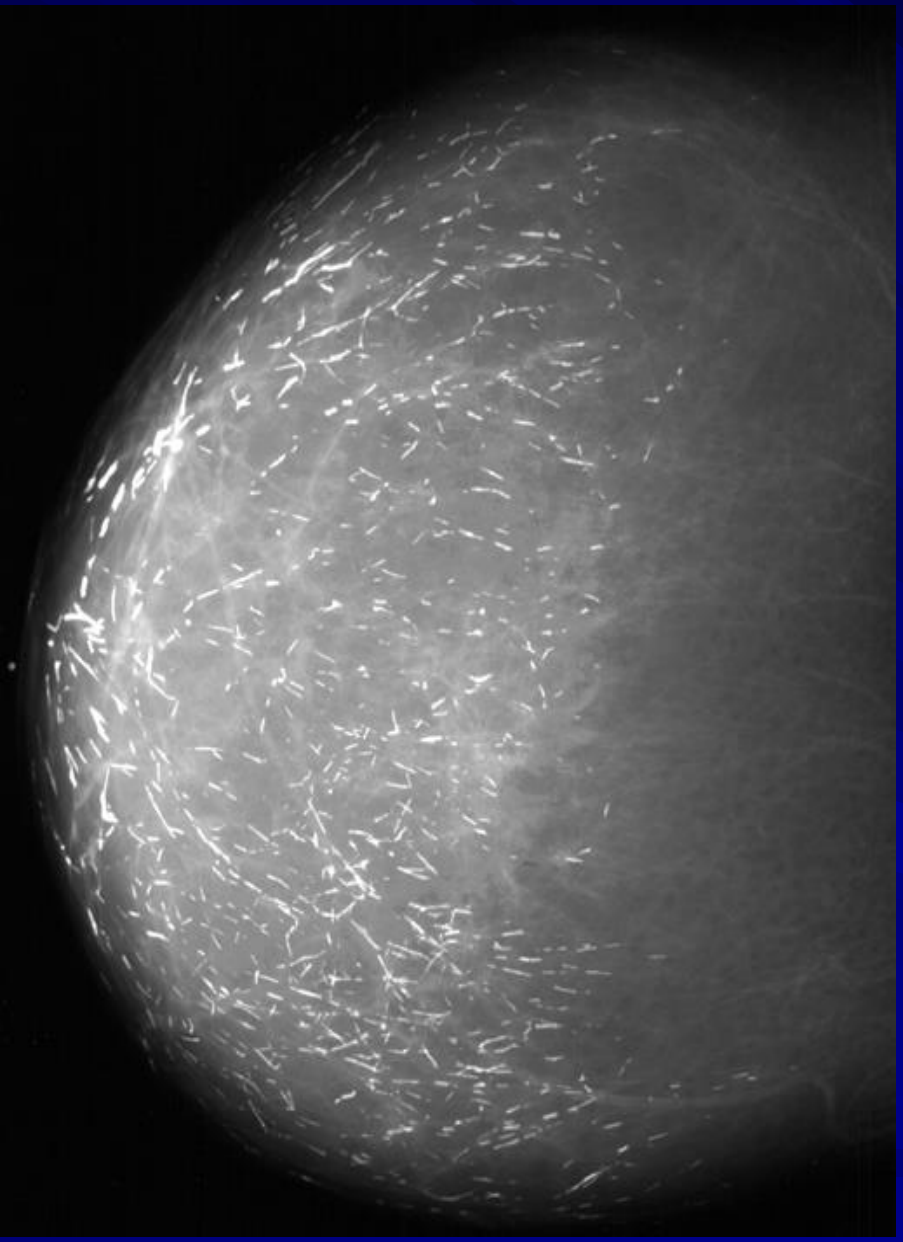


CASE 4: Benign Calcifications



BENIGN CALCIFICATIONS

1-Skin or dermal calcifications.

2- Vascular calcifications.

3-Lucent-centered calcifications (Fat necrosis).

4- Egg-shell or rim calcifications(Fat necrosis or calcification in cyst wall).

5- Coarse or popcorn calcification(Fibroadenoma).

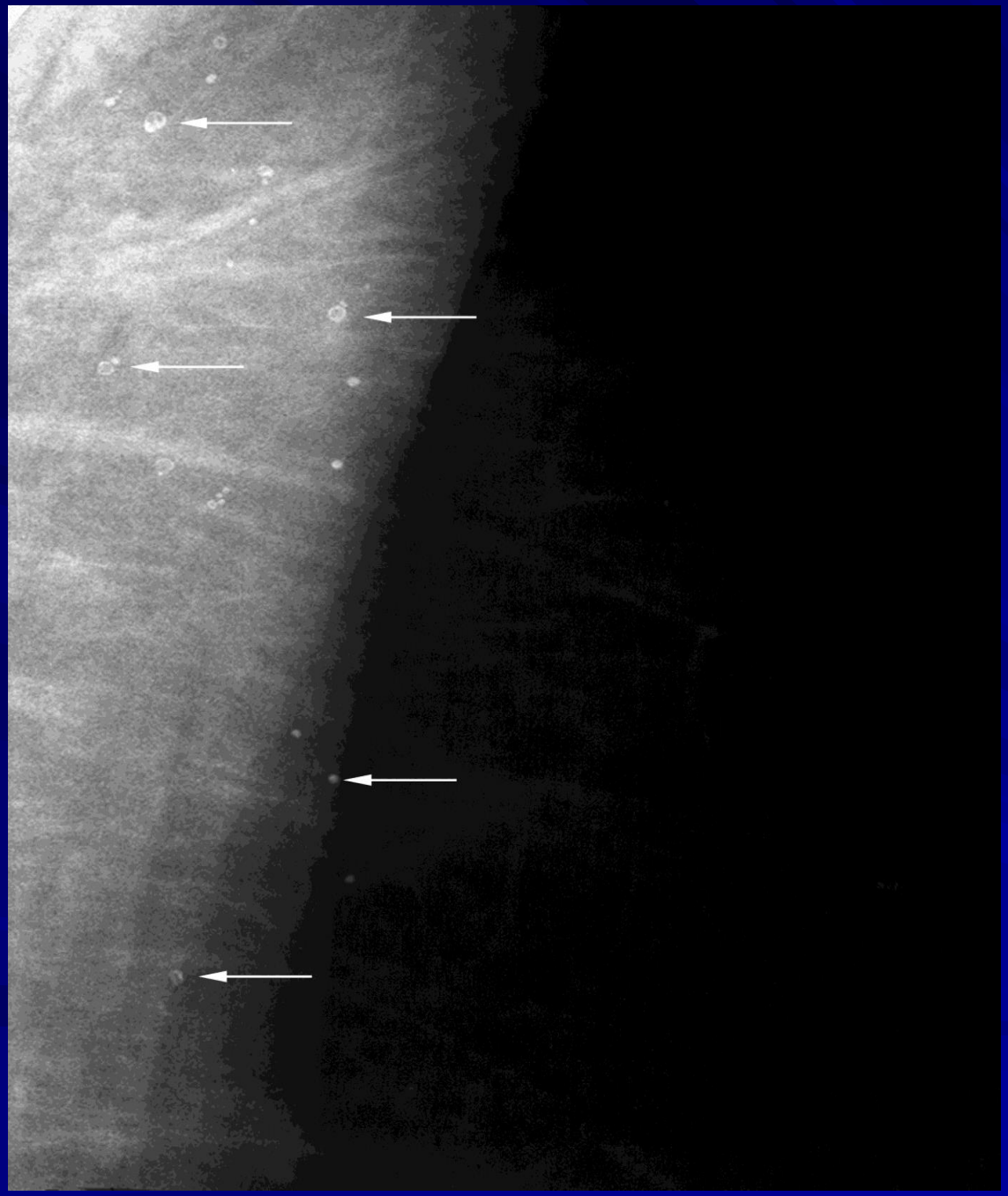
6-Large rod like calcifications or secretory calcifications.

7- Round or punctate calcification (less than 0.5mm).

8-Milk of calcium.

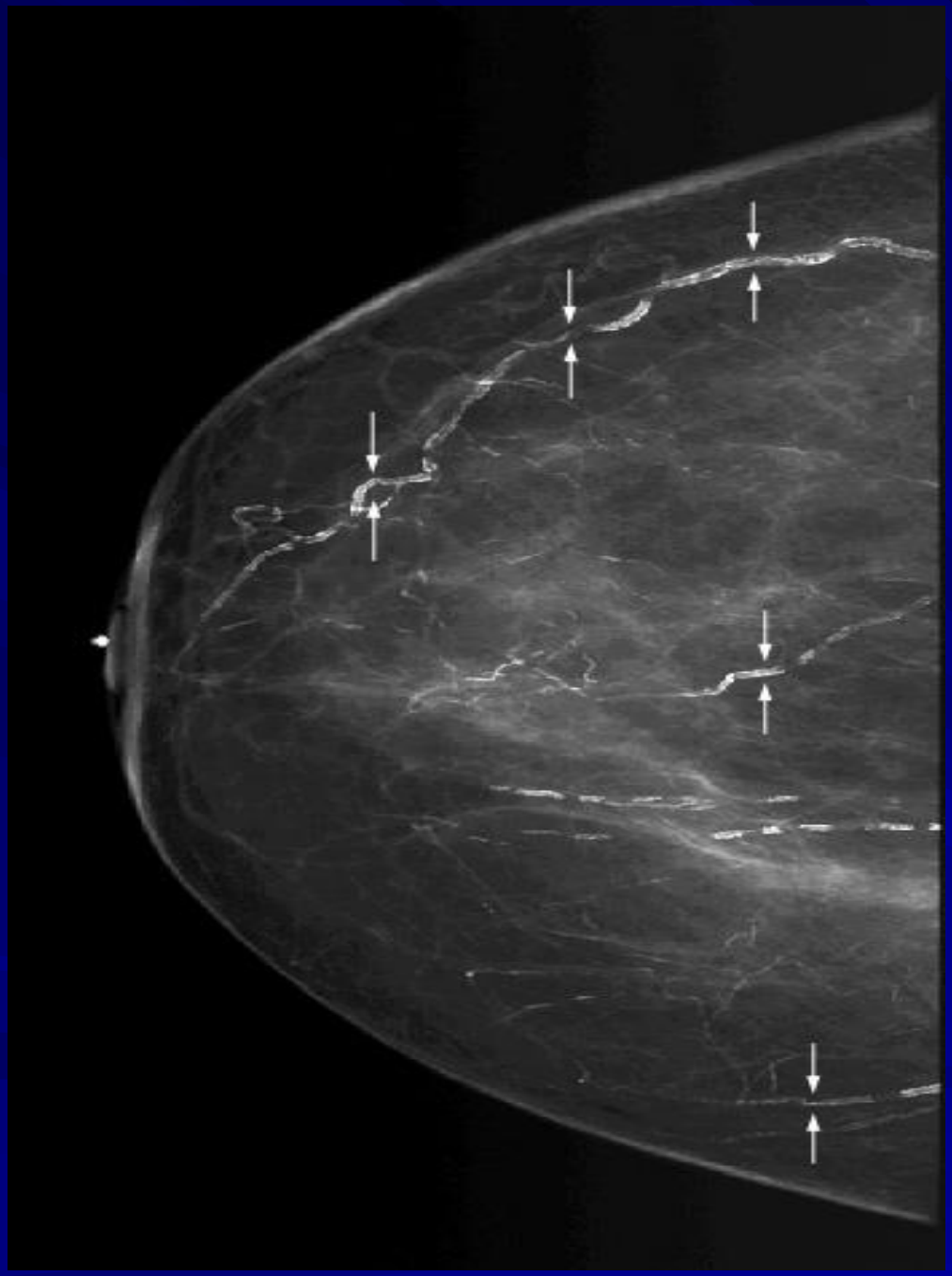
9-Suture calcification.

10-Dystrophic calcifications (Trauma, surgery and irradiation).

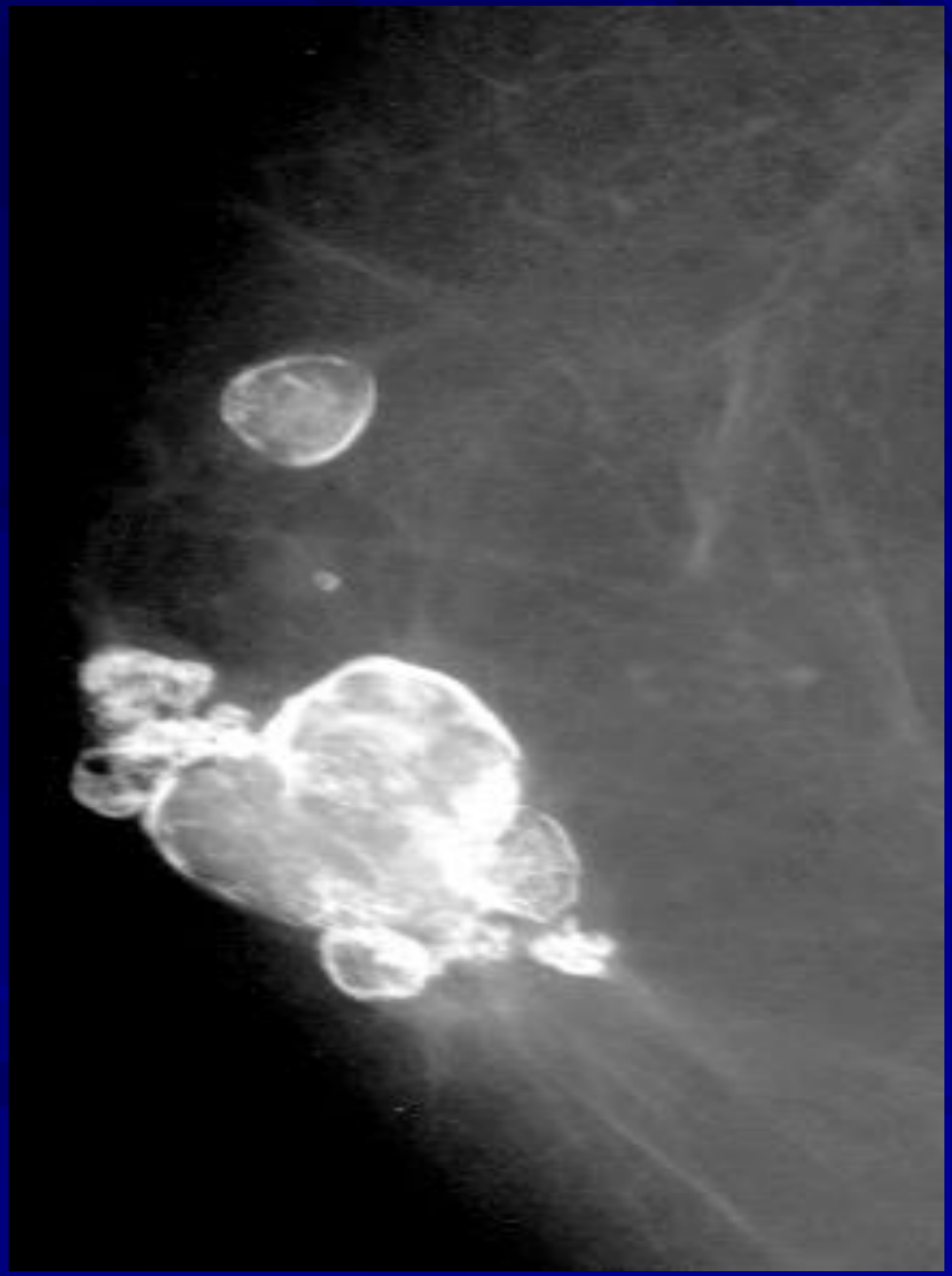


Dermal calcifications

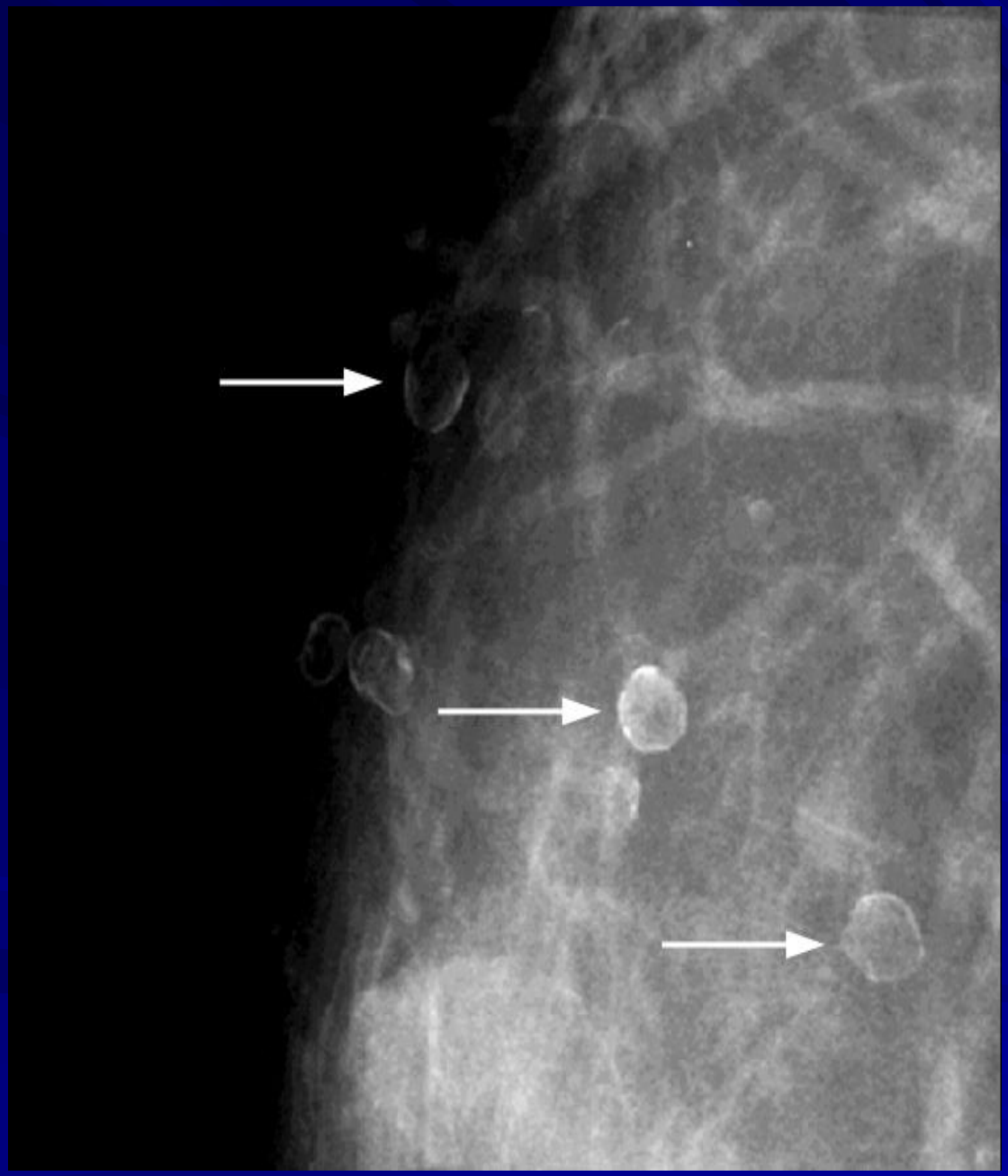
(lucent center)



Vascular calcifications



Lucent-Centered calcifications



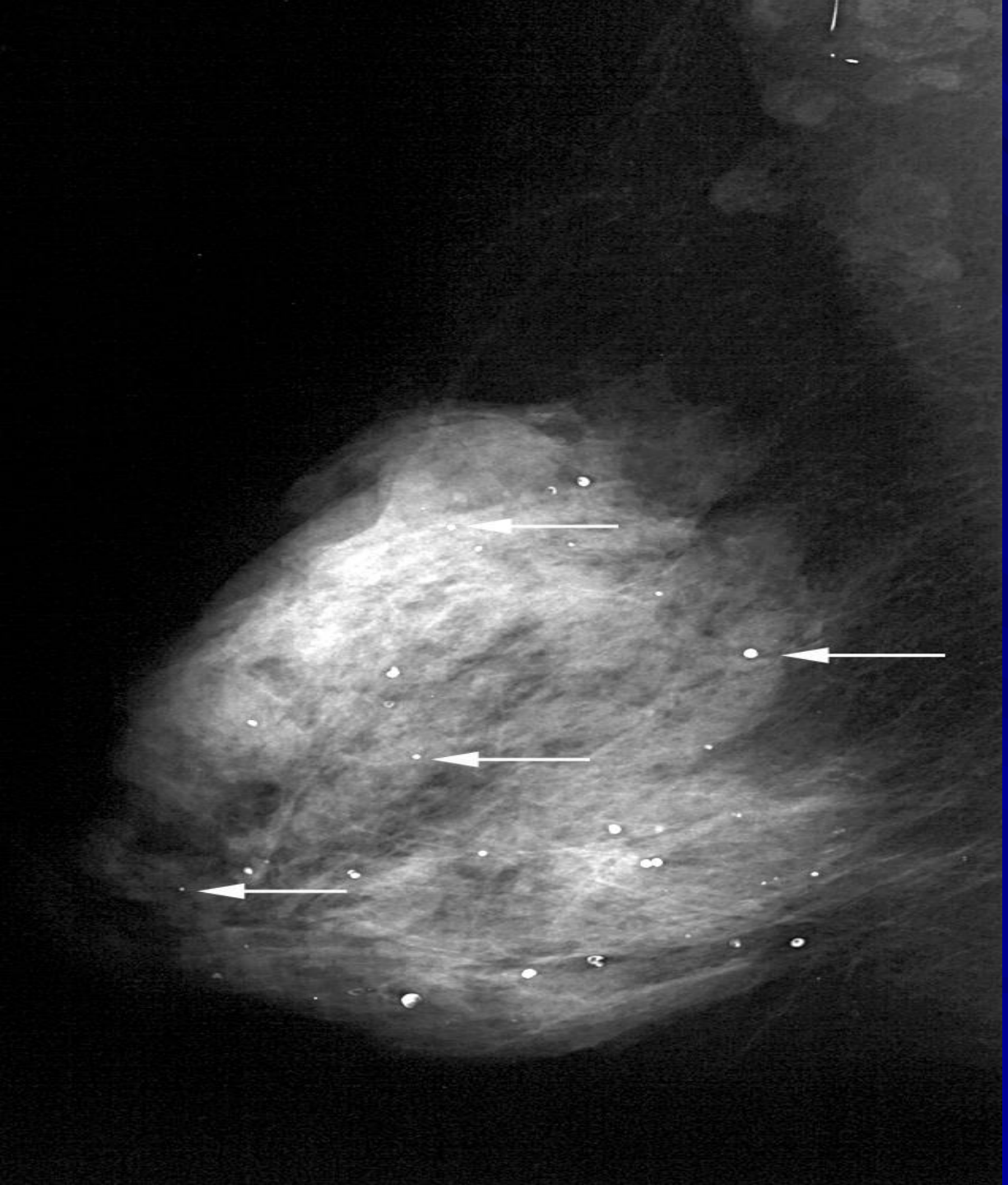
Egg-shell or rim calcifications

Popcorn calcification

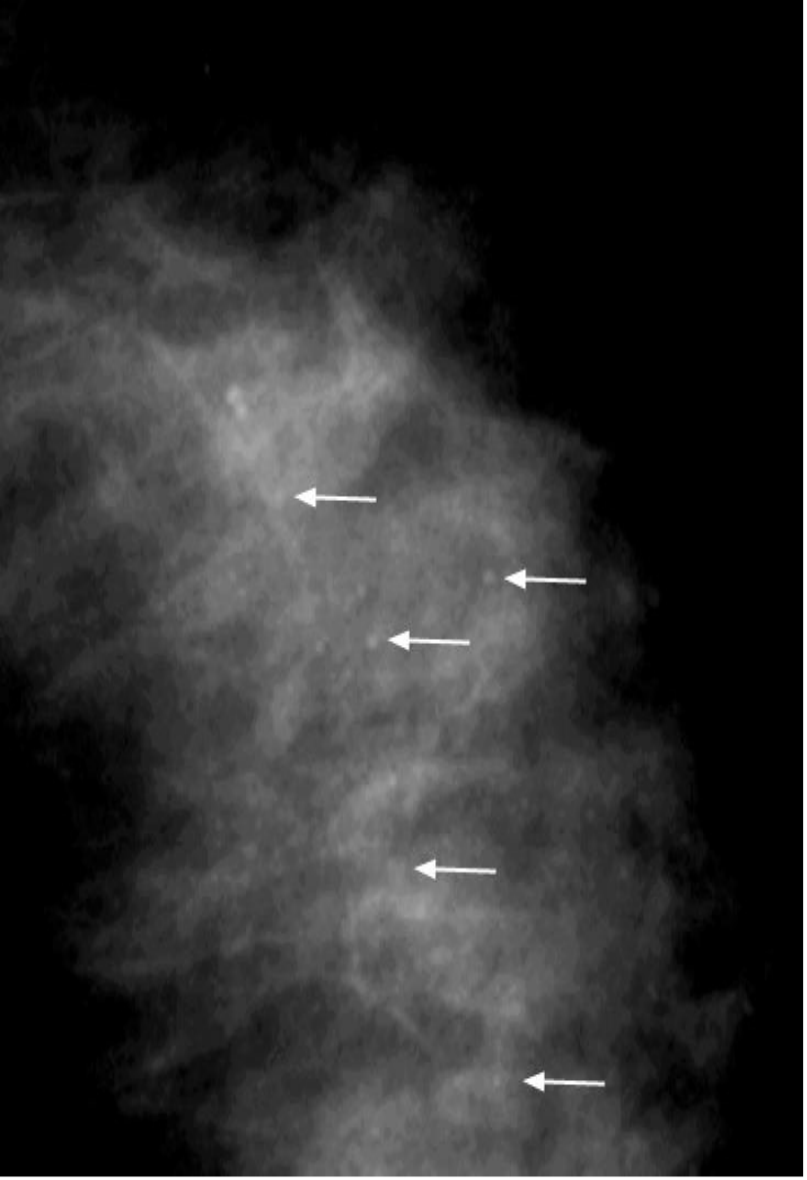
fibroadenoma

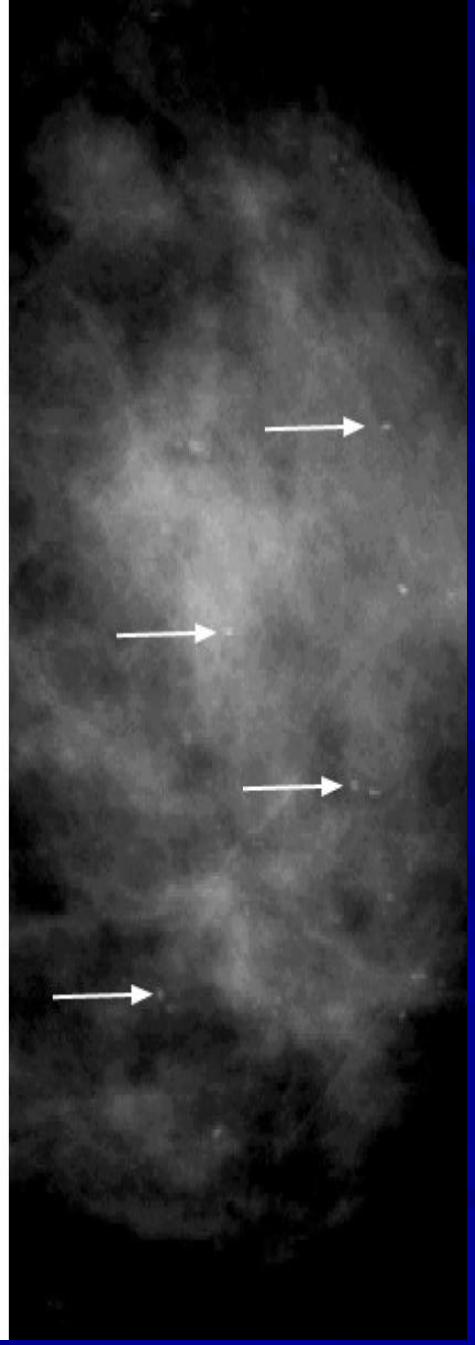
Secretory calcification

nipple ايجول

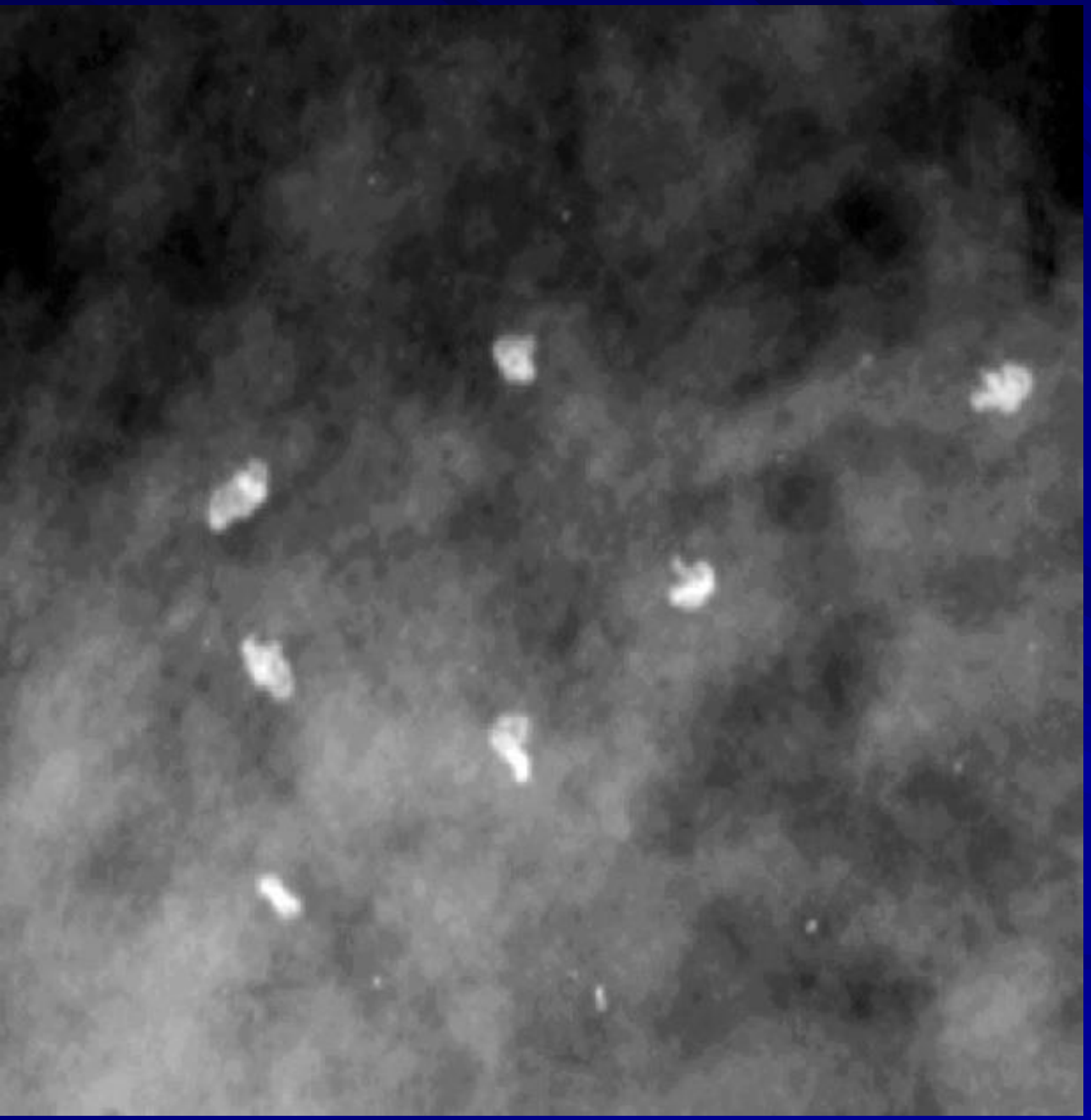


Punctate calcification

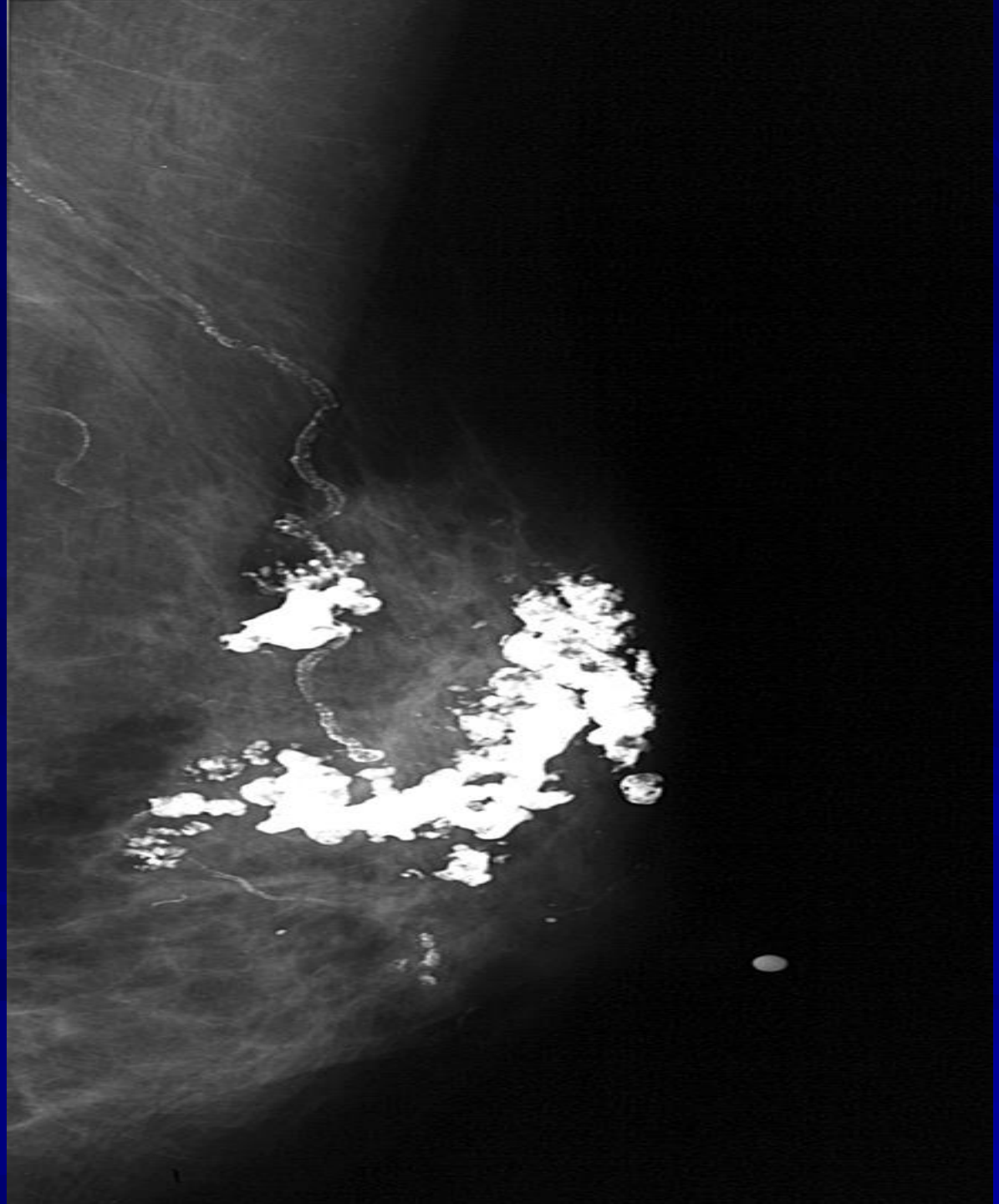




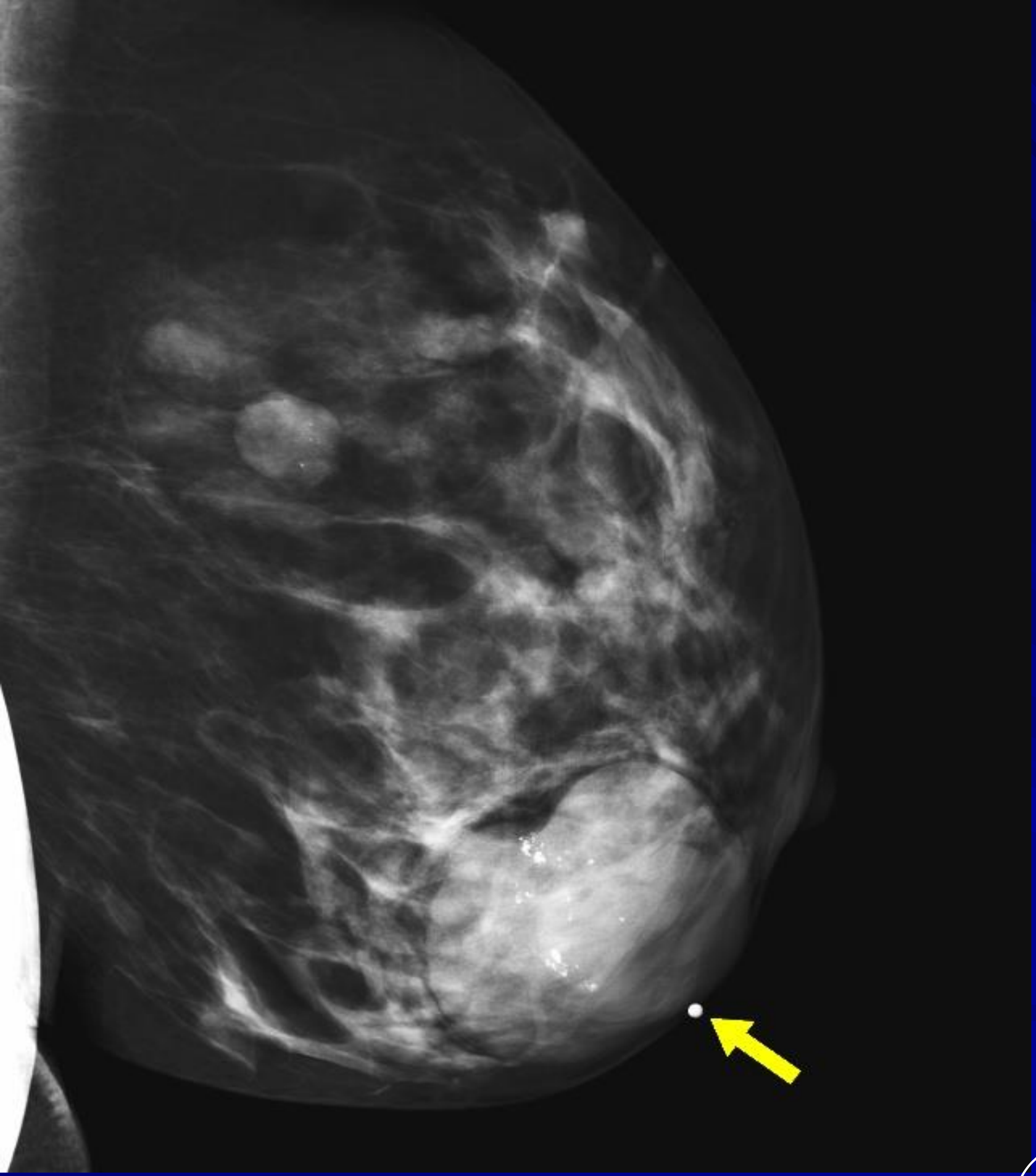
Milk of calcium



Suture calcification



Dystrophic calcification



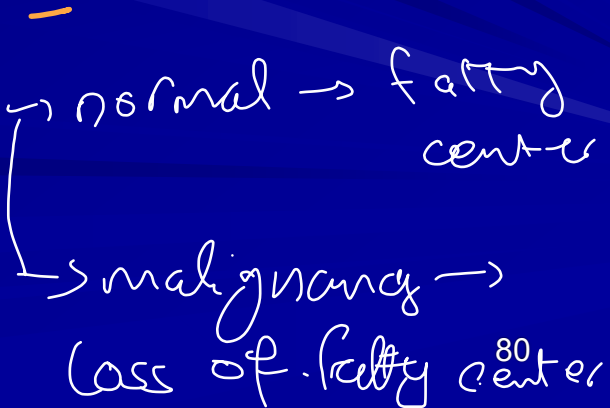
Fibroadenoma:

well-circumscribed, oval-shaped mass with calcification

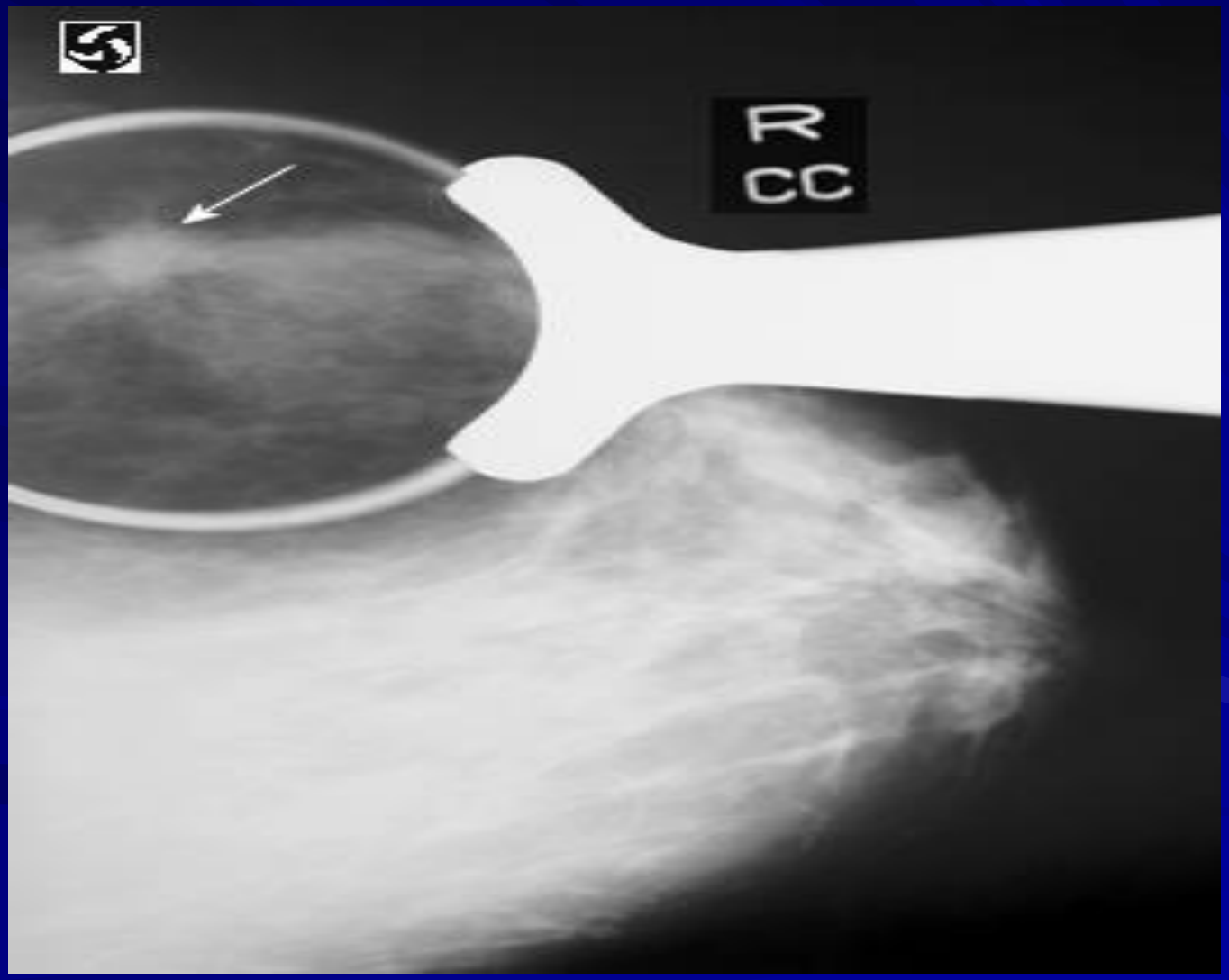
metalic قطعة صغيرة
marker كـ بنحطها
عشان نعرف انا
biopsy اخذنا
من هاد الـ tissue مش قبل

FEATURES OF MALIGNANCY

- 1- Speculated mass
- 2- Architectural distortion
- 3- Asymmetry of breast tissue
- 4- Micro calcification
- 5- Dense mass
- 6- Skin thickening
- 7- Pathological lymph nodes



Speculated mass



Architectural distortion

A focal area of breast tissue appears distorted with no definable central mass.

-Causes:

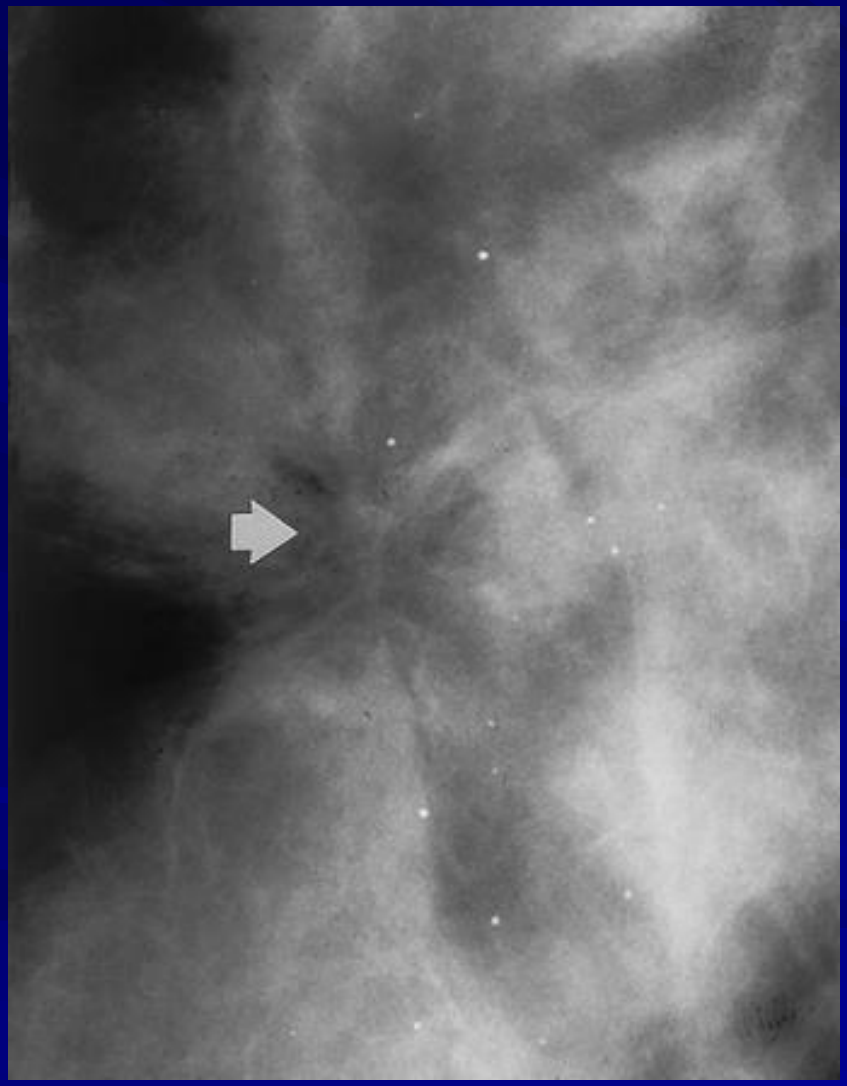
A- Malignancy.

B- Benign lesions as in cases of prior breast injury or surgery or radial scar.

-Benign lesions don’t change overtime.

Sign of malignancy

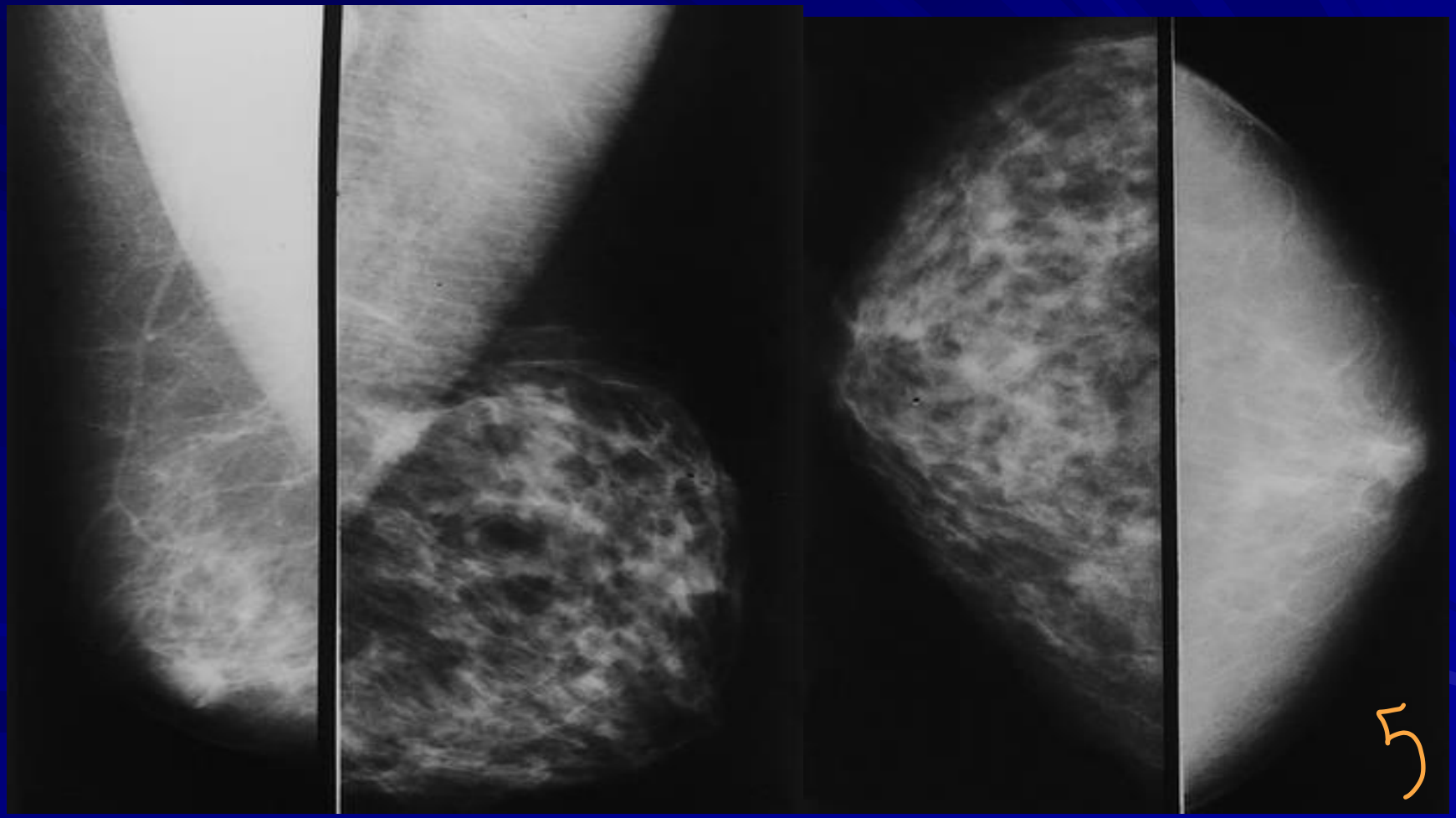
Architectural distortion



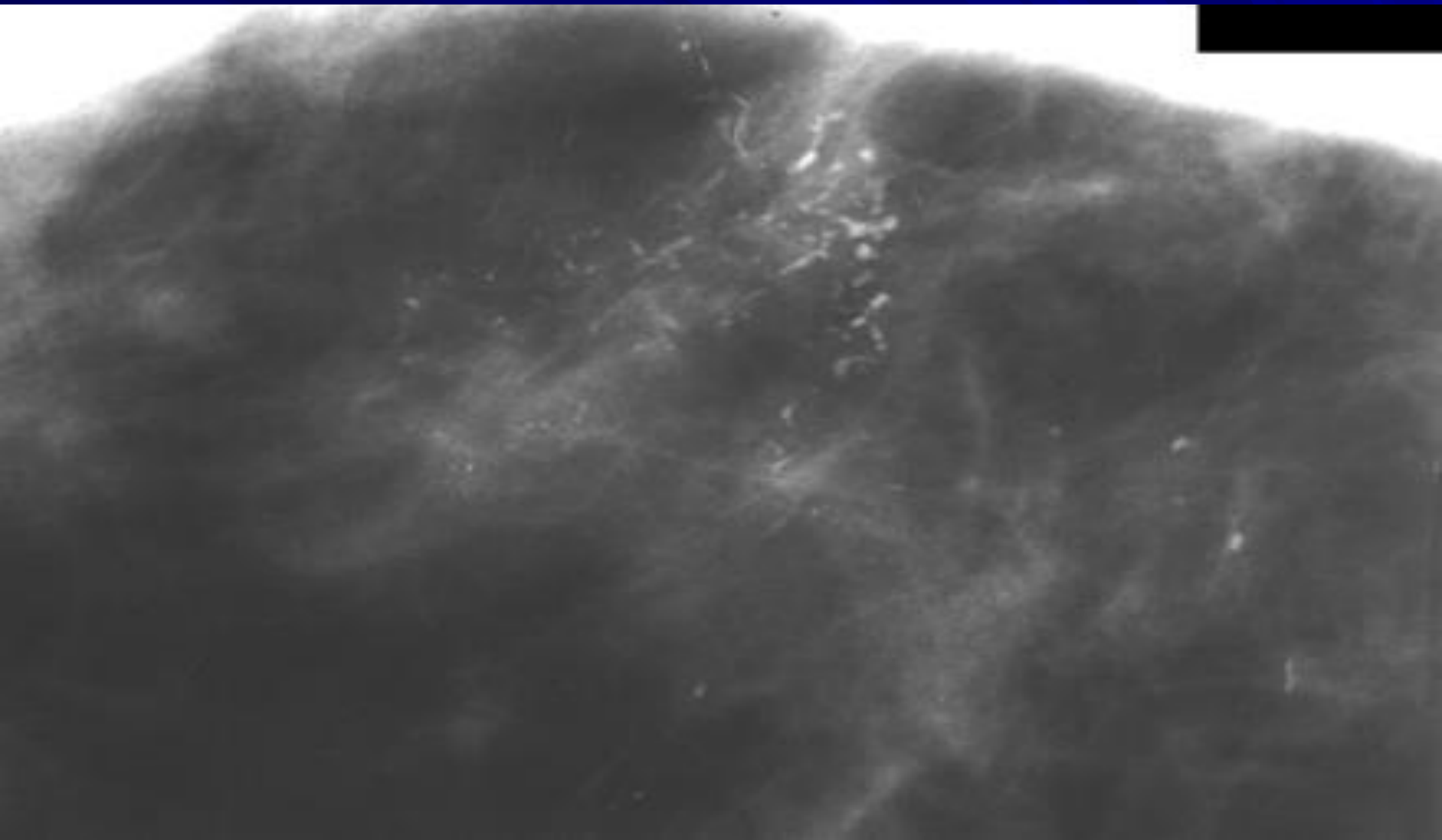
ASYMMETRY OF BREAST TISSUE

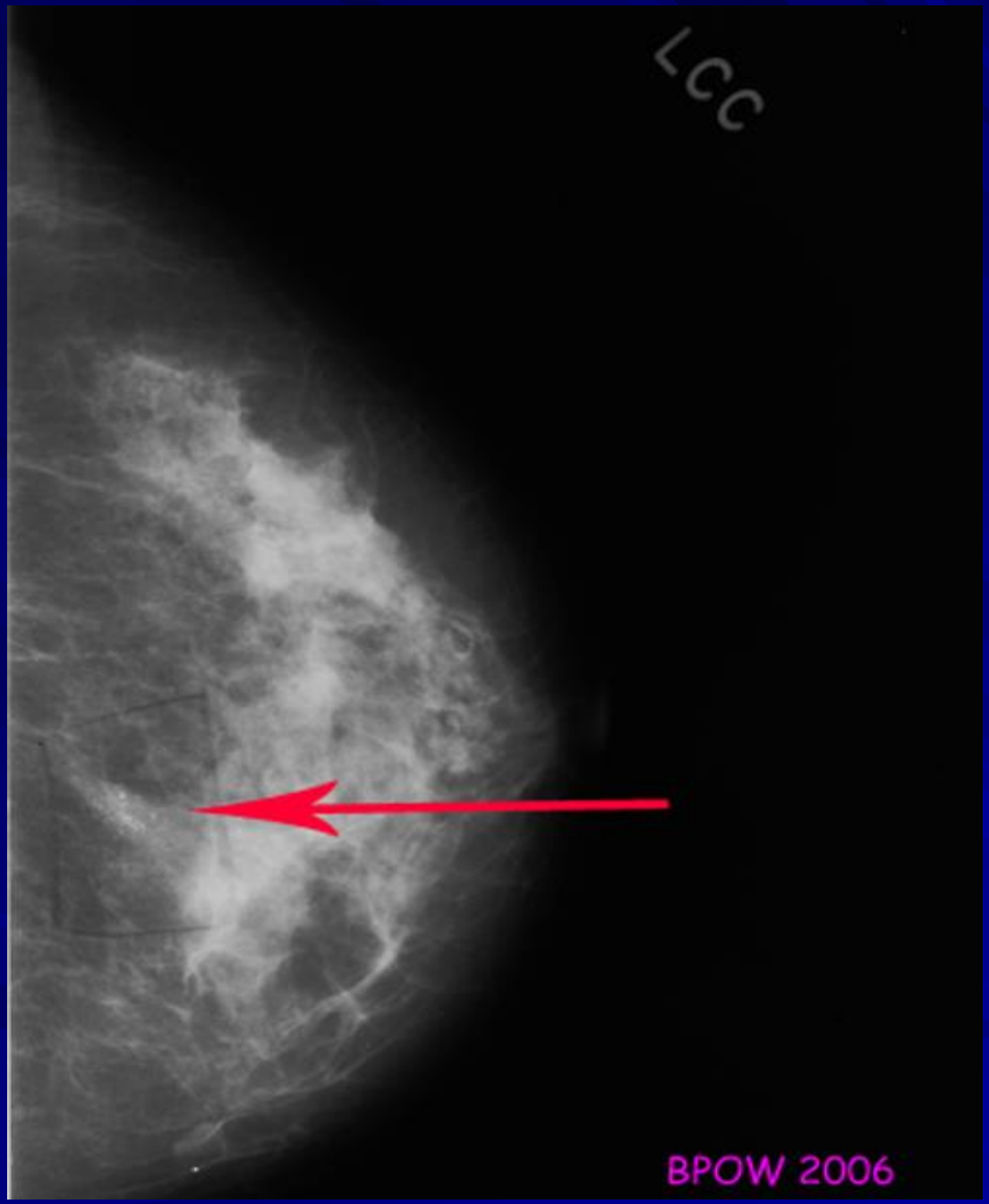
Greater volume or density of breast tissue in one breast than corresponding area in the contralateral breast.

ASYMMETRY OF BREAST TISSUE



- Linear and branching micro calcification

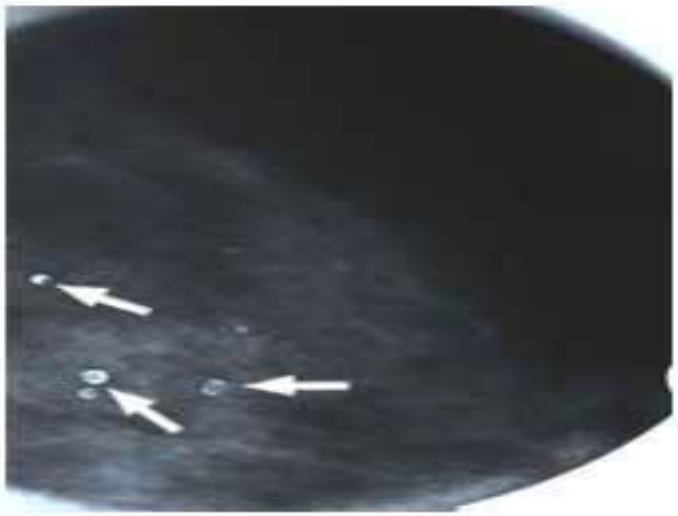


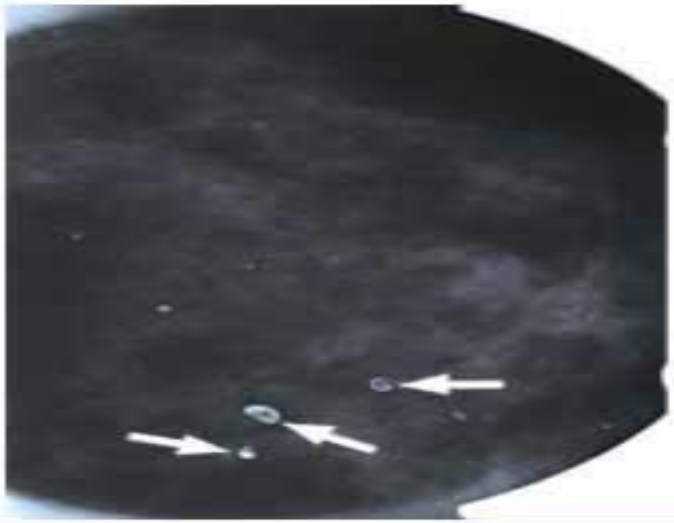


Cluster of calcifications

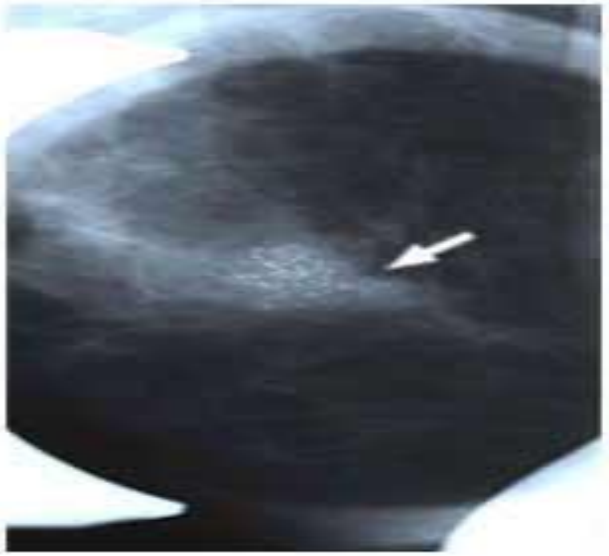
malignant

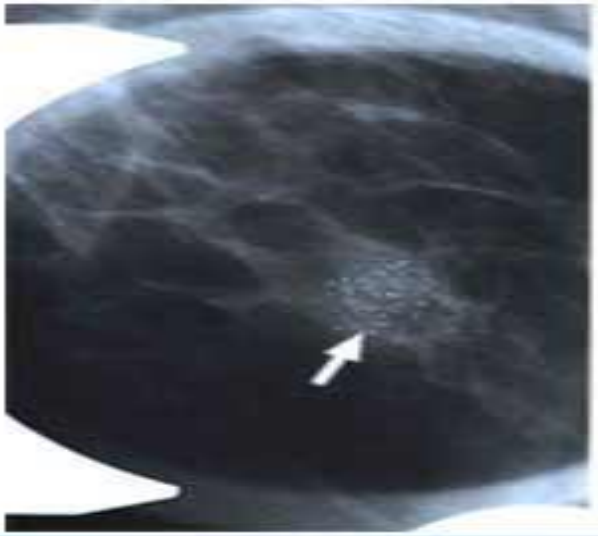
Noncancerous (benign) calcifications





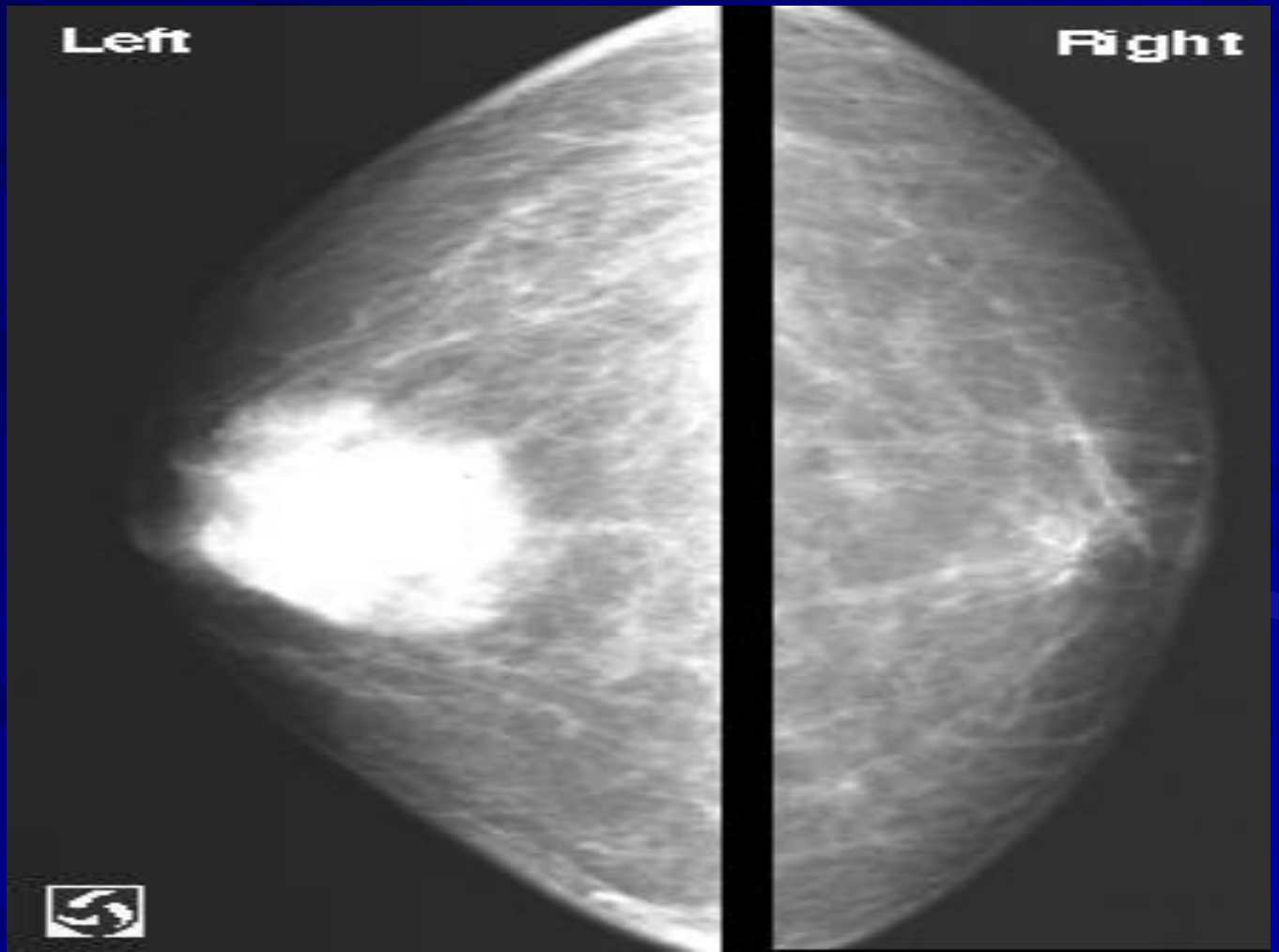
Cancerous (malignant) calcifications





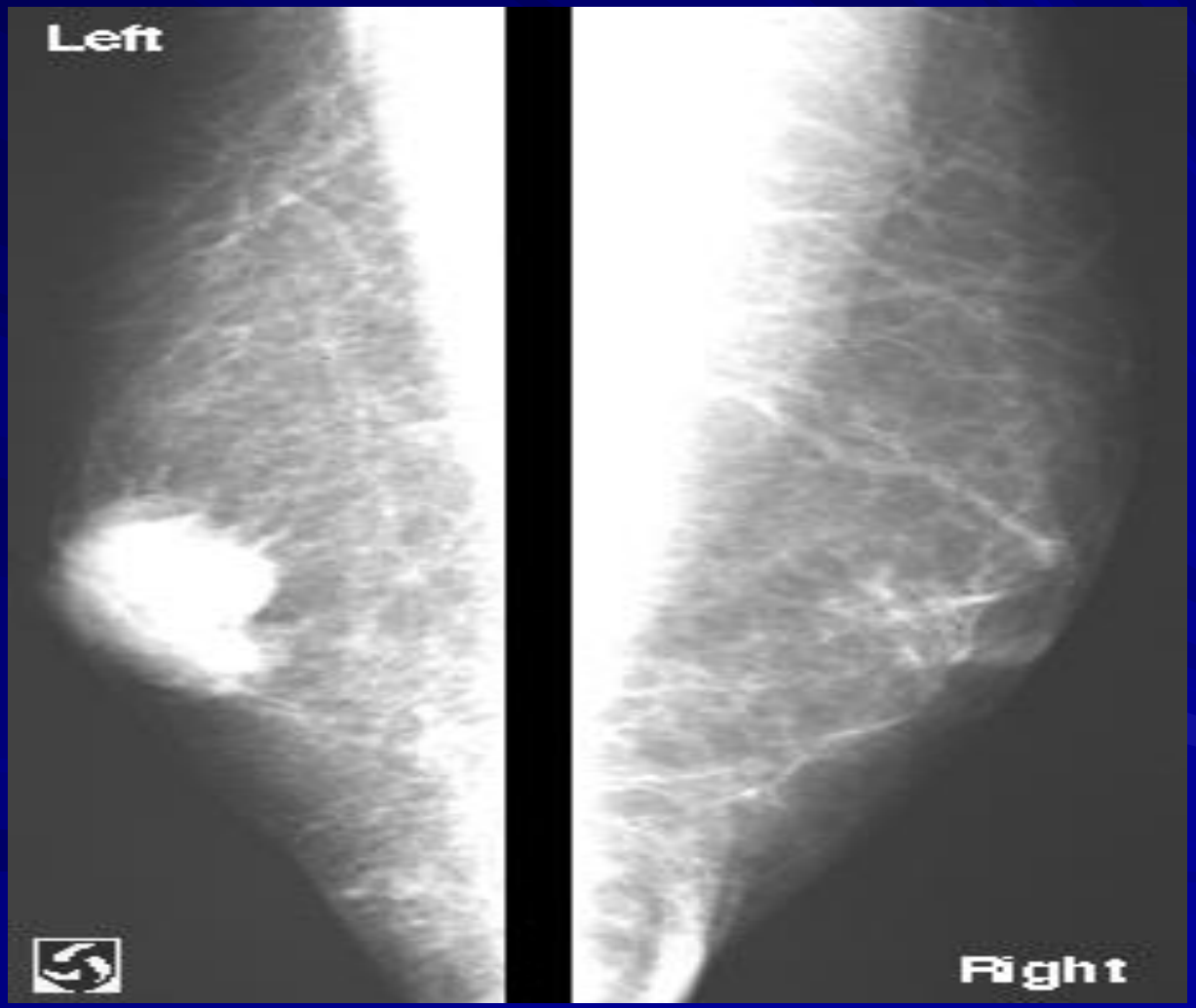
Dense mass

CC



Dense mass

malignant



On the mammogram report

- BIRADS CODING

CATEGORY 0 Incomplete ; needs further evaluation.

CATEGORY 1 Negative mammogram

CATEGORY 2 Benign findings.

CATEGORY 3 Probably benign finding- short interval follow up is suggested.

CATEGORY 4 Suspicious abnormality- Biopsy should be considered.

CATEGORY 5 Highly suggestive of malignancy – Appropriate action should be taken

CATEGORY 6 Proven malignancy

ACR/ACS Breast Cancer Screening Guidelines

- Annual mammography age 40 and older
  - Reduction in mortality by 30-50%
- Earlier if mother or sister diagnosed with breast cancer (10 y. < age of relative's diagnosis)
- Annual MRI for high risk per guidelines criteria
- Annual CBE age 40 and older
  - Q 3 years age 20-40
- SBE encouraged

Diagnostic Breast Imaging

- For symptomatic patients or those with an imaging finding
- Negative screening mammogram never replaces need for diagnostic mammogram
- Ultrasound essential in majority of (but not all) women for complete work up of palpable abnormality
- MRI can play an important role in specific clinical settings

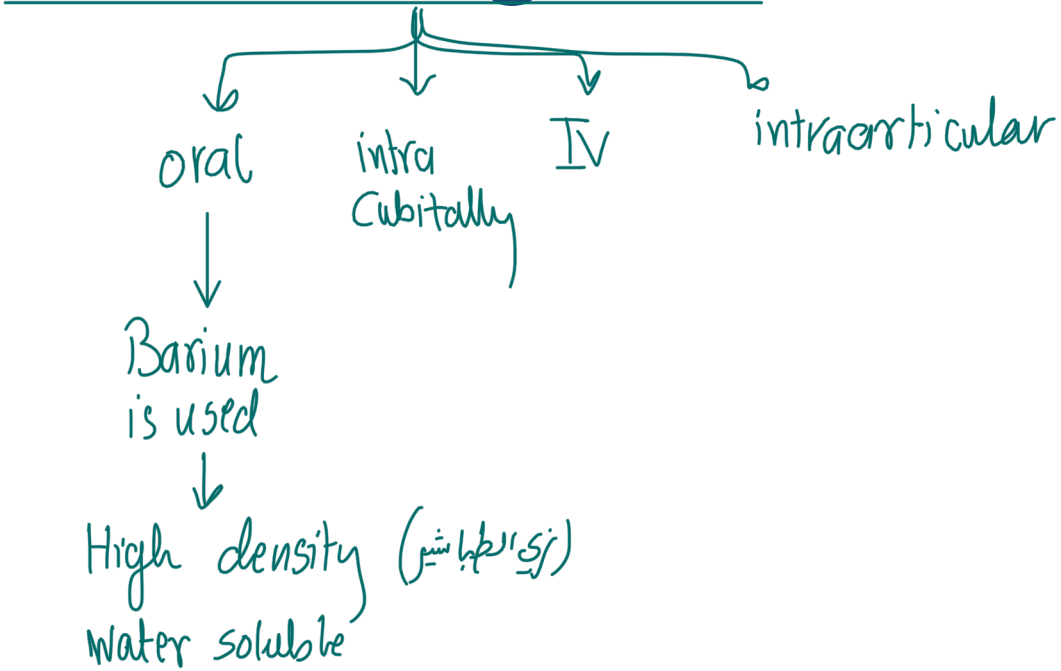
LIMITATIONS OF MAMMOGRAPHY

- As many as 5 – 15% of breast cancers are not detected mammographically
- A negative mammogram should not deter work-up of a clinically suspicious abnormality

FALSE NEGATIVES

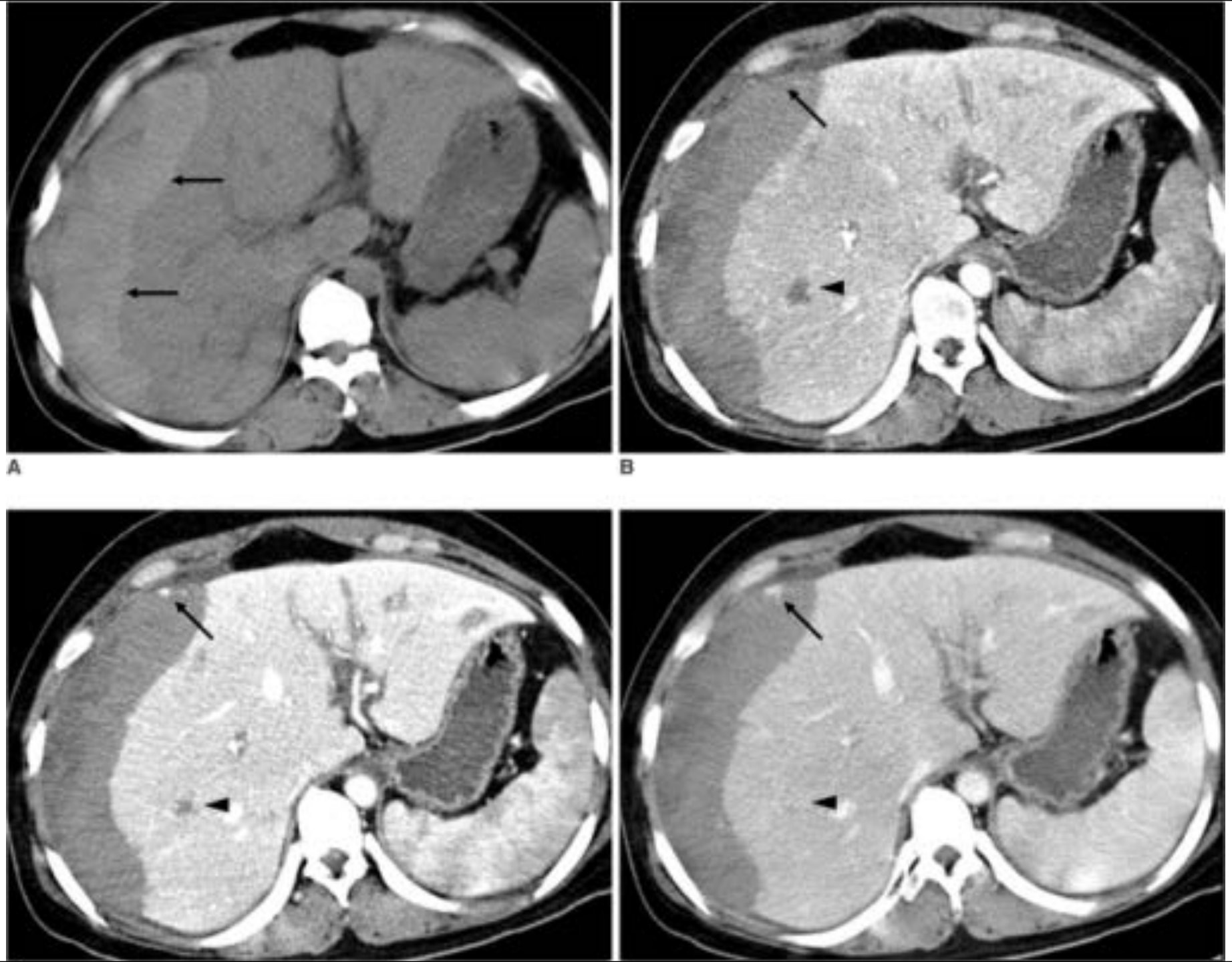
- Causes
  - Occult on mammogram (lobular CA)
  - Finding obscured by dense tissue
  - Technical
  - Error of interpretation

Contrast agents



Positive

Negative (Developed)
Radiograph, “Plain Film”


A
B

- Substance, such as:
  - Barium
  - Iodine
  - Air
- Used in radiography to increase the contrast of an image.
- A positive contrast medium absorbs x-rays more strongly than the tissue or structure being examined
- A negative contrast medium, less strongly.

*High density material used to see things that can't be seen without it
*Not a radio-active material
*Mostly excreted
*Not absorbed inside the body

Contrast is used in medical imaging to make normal structures and some lesions look more conspicuous.

Contrast can be

- Positive (iodinated **contrast** in CT)
- Negative (air in double **contrast** barium studies)

Contrast media is usually specific to the imaging modality and organ systems.

X-ray contrast agents

- Intravascular contrast agents (**iodinated**)
  - HOCA
  - Non-ionic LOCA (most commonly used)
  - Iso-OCA (most safe & expensive)
- Barium → Oral
  - Barium sulfate

Contraindicated in complete intestinal obstruction

High osmolar contrast agents (HOCA)

- Osmolality → 1500 – 2000mOsm (normal ~280)
- Examples:
  - Diatrizoate (Hypaque / Gastrografin)
  - Iothalamate (Conray)

Low osmolar contrast agents (LOCA)

- Non-ionic
- Osmolality → 400 – 450
- Have a lower incidence of adverse reactions.
- Examples:
  - Iopamidol (Isovue)
  - Iohexol (Omnipaque)
  - Ioprmide (Ultravist)

- Most often they are used intravenously, but for various purposes they can also be used intraarterially, intrathecally (the spine) and intraabdominally - just about any body cavity or potential space.

Side effects

- Mucocutaneous reactions – flushing- rhinorrhea- urticaria- angioneurotic edema.
- Nausea & vomiting.
- Headache
- Thrombophlebitis & venous thrombosis – Sloughing of skin.
- Abdominal pain.
- Bronchospasm.
- Hypotension & tachycardia.
- Convulsions.
- Cardiac arrest – coronary artery spasm during anaphylactoid reaction.
- Mortality rate:
  - 1/ 40,000 with HOCA
  - 1/ 200,000 with LOCA

Risk factors for developing side effects

- Allergies , Asthma , Atopy.
- Cardiac disease.
- Previous reaction to contrast agents.

High risk patients should either:

- Premedicated with steroids.
- Receive non-ionic agents.
- Evaluate by U/S or MRI.

Mechanism of contrast induced nephrotoxicity

- Incidence of 5%
- Predesposing factors (Not HTN):
  - Pre-existing renal impairment.
  - DM & old age.
  - Very large dose.
  - Multiple myeloma. Plasma cell tumor
- The mechanisms:
  - Impaired renal perfusion.
  - Glomerular injury
  - Tubular injury

High
, they have benze jones protein in blood
↓
Hemolysis

*Low osmolar contrast media

*Quality of image is less than barium

Gastrografin

أصبح في التاريخ ، ماحدا بيستخدمه

*كان يستخدم بديل ال Barium في حالات ال Perforation أو Obstruction

- Oral contrast agent for opacification of GI tract.
- **Safe** in cases of perforation.
- Causes chemical pneumonitis if aspirated, so **contraindicated** in tracheo-esophageal fistula.
- Also diarrhea & hypovolemic shock in pediatrics.
- Barium enema is therapeutic & diagnostic in intussusception.

*Easy absorbed (الباريوم بيقعد أسبوعين) 24 hours

*Expensive

*Dangerous when aspired

*Water-soluble, indecated in gastric perforation (Safe on peritonium)

*Contraindication :- Aspiration

Barium

- Barium swallow (thick)
- Barium meal (in-between)
- Barium enema (thin)

Barium sulfate

- Insoluble white powder.
- Mixed with water and some additional ingredients to make the contrast agent.
- As the barium sulfate doesn't dissolve, this type of contrast agent is an opaque white mixture.
- It is only used in the digestive tract
- It is usually swallowed or administered as an enema.
- After the examination, it leaves the body with the feces.

Complications

- Exacerbation of large bowel obstruction.
- Intraperitoneal extravasation through perforation results in extensive fibrosis.

MRI contrast agents

- Contrast agents are also used in MRI (Magnetic Resonance Imaging). Although MRI is usually considered a branch of radiology, it is not based on X-rays. MRI contrast agents are usually gadolinium-based, and work not by being radioopaque, but rather by altering the magnetic properties of nearby hydrogen nuclei.

MR contrast agents

- Paramagnatic agents (Gadolinium DTPA) Magnevist
  - Enhances the relaxation rates of protons in it`s vicinity.
  - Excretion **95%** by glomerular filtration & 5% hepatobiliary.
  - Half-life: **90 min**utes.
  - Incidence of minor side effects 1.5 % like:
    - Headache
    - Nausea
    - Seizures
- Super paramagnetic agents:
  - **Large** supramagnatic iron oxide: Ferridex
  - **Ultrasmall** supramagnatic iron oxide: Ferrumoxtran.

Barium

- Barium swallow, is a medical imaging procedure used to examine the **upper GIT** (esophagus & stomach)
- Barium meal (**upper gastrointestinal series**) is a procedure in which radiographs of the esophagus, stomach and duodenum are taken after barium sulfate is ingested by a patient.Barium meals are useful in the diagnosis of structural and motility abnormalities of the foregut.
- Barium enema (**lower gastrointestinal series**) is a medical procedure used to examine and diagnose problems with large intestine. X-ray pictures are taken while barium sulfate fills the colon via the rectum.

Indications

There are no contraindications

Barium swallow

- Dysphagia
- Hiatus hernia
- Achalasia
- Tumors
- Any esophageal abnormalities

Barium meal

- Abdominal pain
- IBD
- Stomach & duodenum problems
- We use concentrated Barium (1 glass)

Contraindication in perforation + Complete intestinal obstruction

↳ peritonium » على ينزل بيتاف

Barium swallow

*examination of esophagus

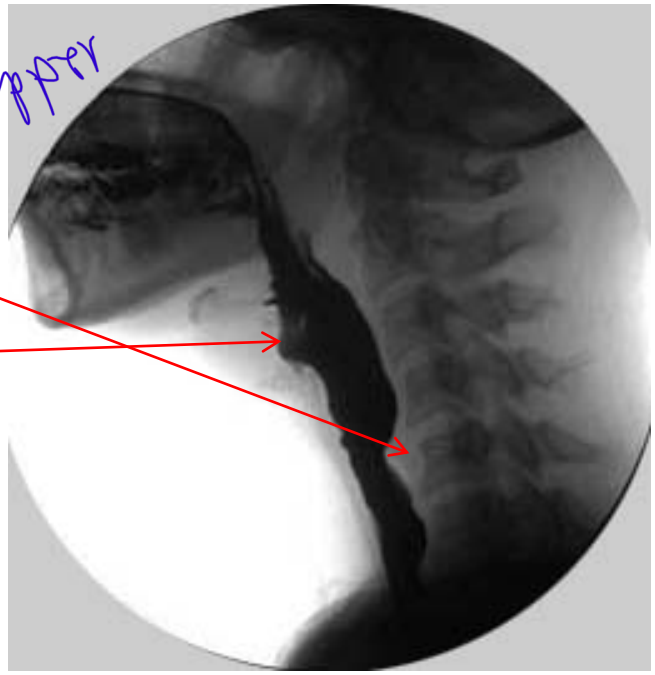
- Aortic arch
- Left main bronchus

Hypopharynx esophagus

- Cricopharyngeal muscle
- Cricopharyngeal venous plexus

middle

upper



Thoracic esophagus

- Aortic arch
- Left main bronchus
- Normal indentation

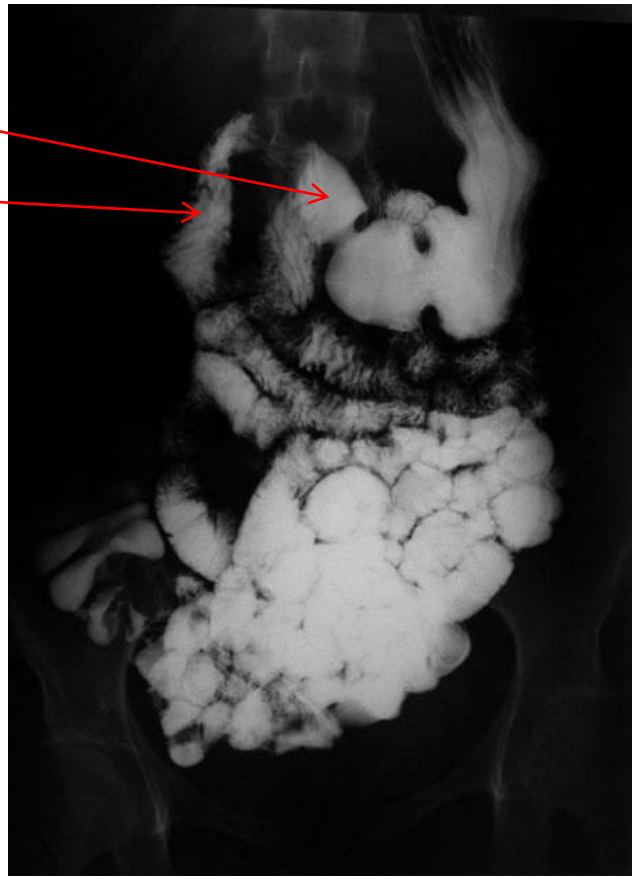
lower

Barium meal & follow through

→ 2 caps

بنستنى ربع ساعة -

Duodenum
- 1st part
- 2nd part



برخلي المريض يدور حوليين نفسه

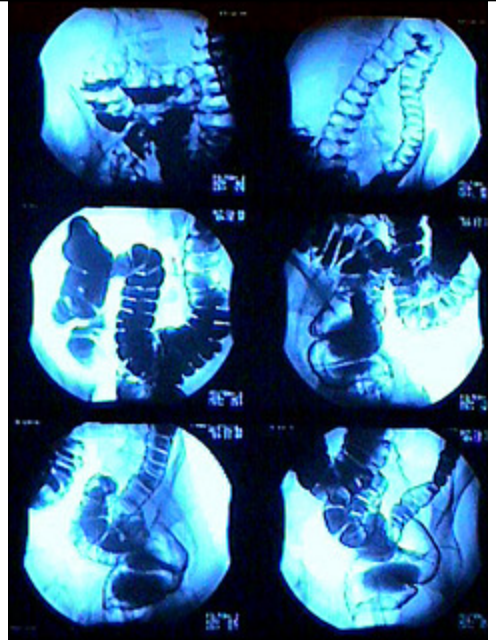
1- Give barium
2- حكي المريض يلف
3- نفخ المعدة .

* examination of small bowel.
* Duodenum
* jejunum

*Terminal ilium :-

Barium enema

*تصوير القولون .



Indication 1- Perforation

↓

Absolute

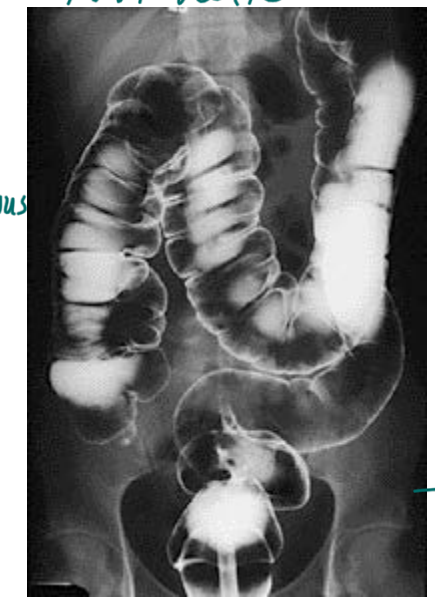
↓

1- Perforation
2- Toxic Mega colon
3- Pseudomembranous Colitis
4- Recent rectal biopsy

Relative

↓

1- incomplete bowel preperation
2- Recent barium study



Toxic Megacolon

*Preperation:- 1- Fasting
2- laxatives . for 2 days

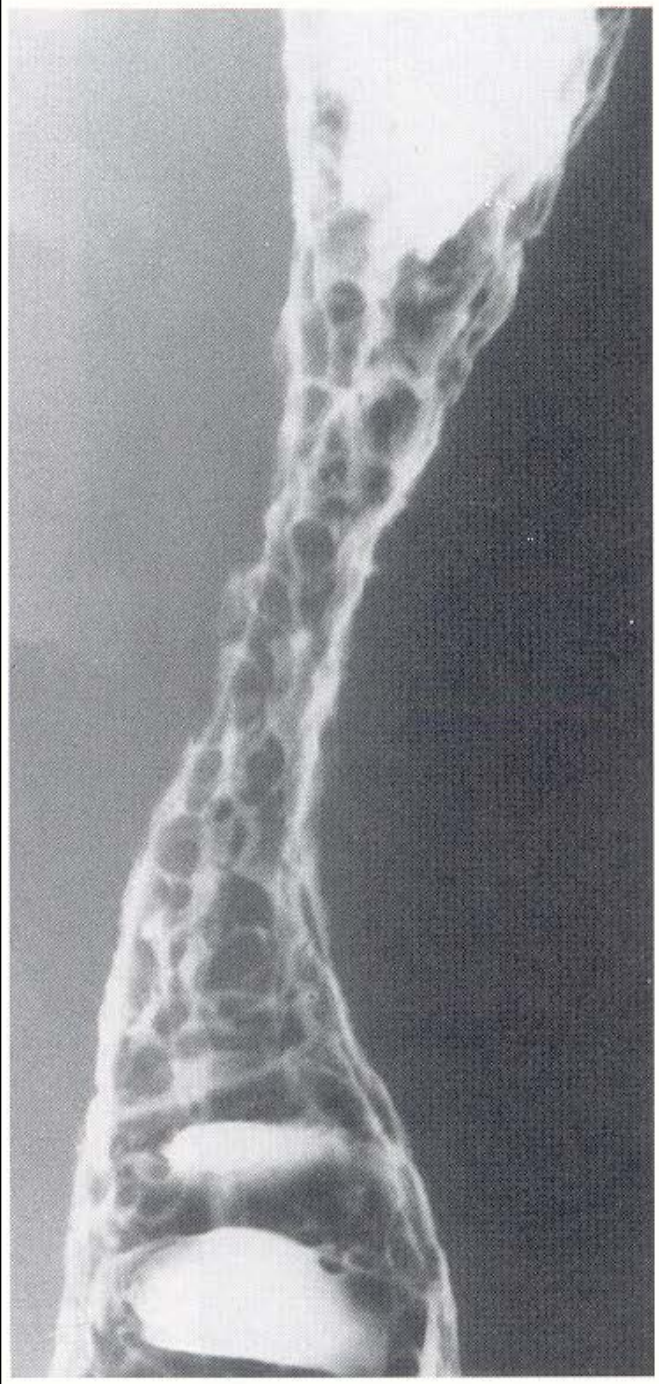
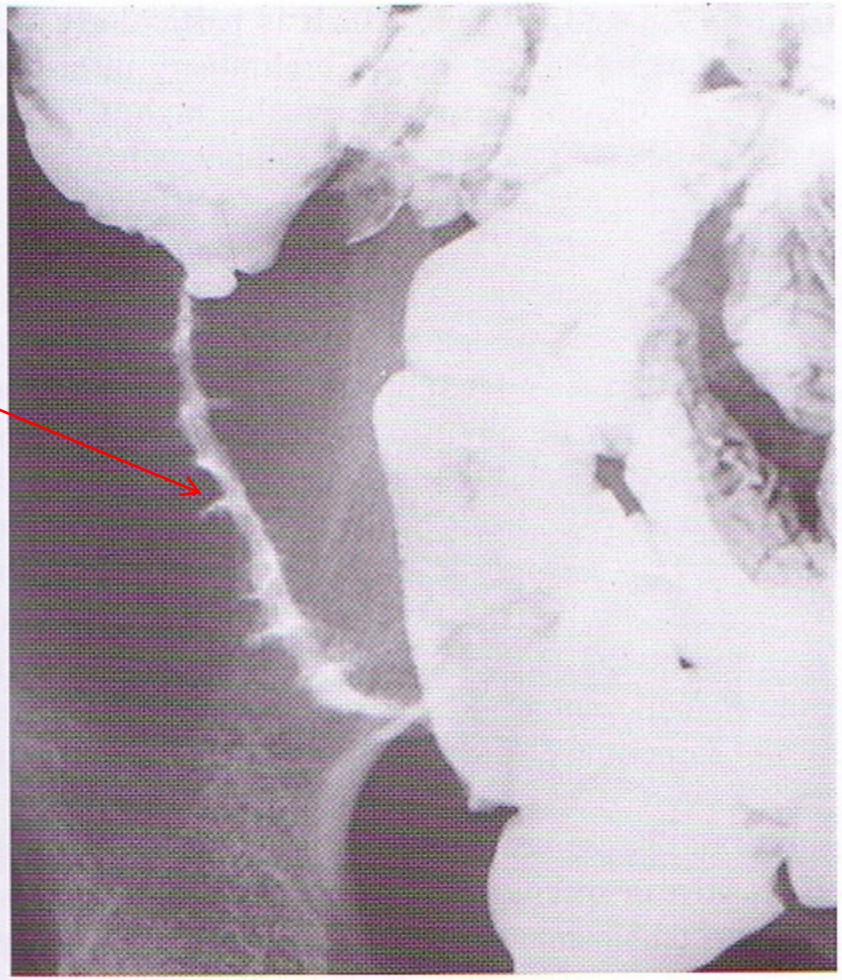


FIGURE 54–24. Crohn's disease: cobblestone mucosa. Longitudinal and transverse ulcers at the descending colon produce a cobbled appearance in this patient with severe Crohn's colitis. (Courtesy of Keith C. Simpkins, M.D., Leeds, England.)

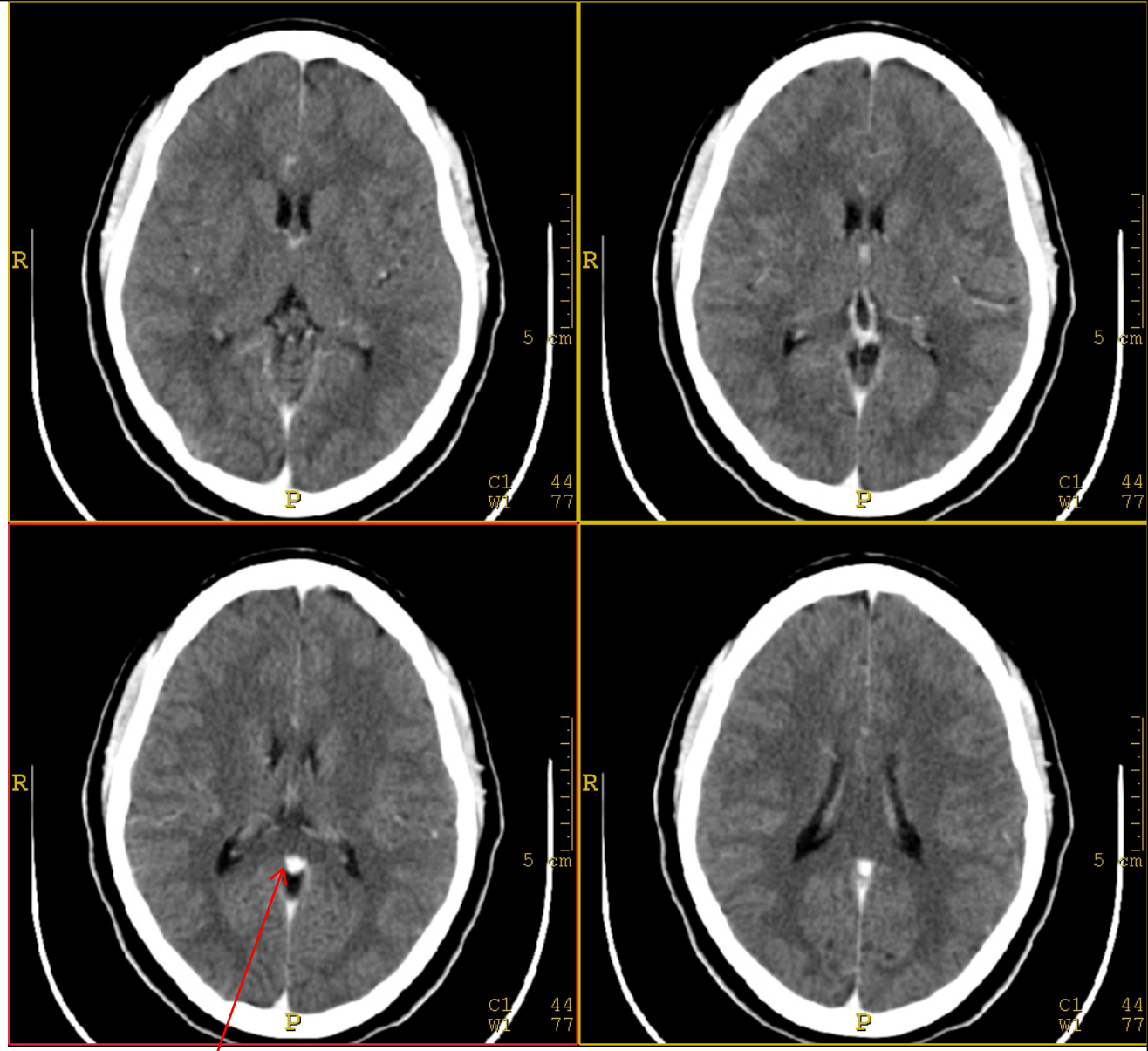
Terminal ileum:

- Pseudodiverticulum
- Stricture
- Scarring
- Narrowing



20.16 Crohn's disease. Neoterminal ileal recurrence at right hemi-ectomy site.

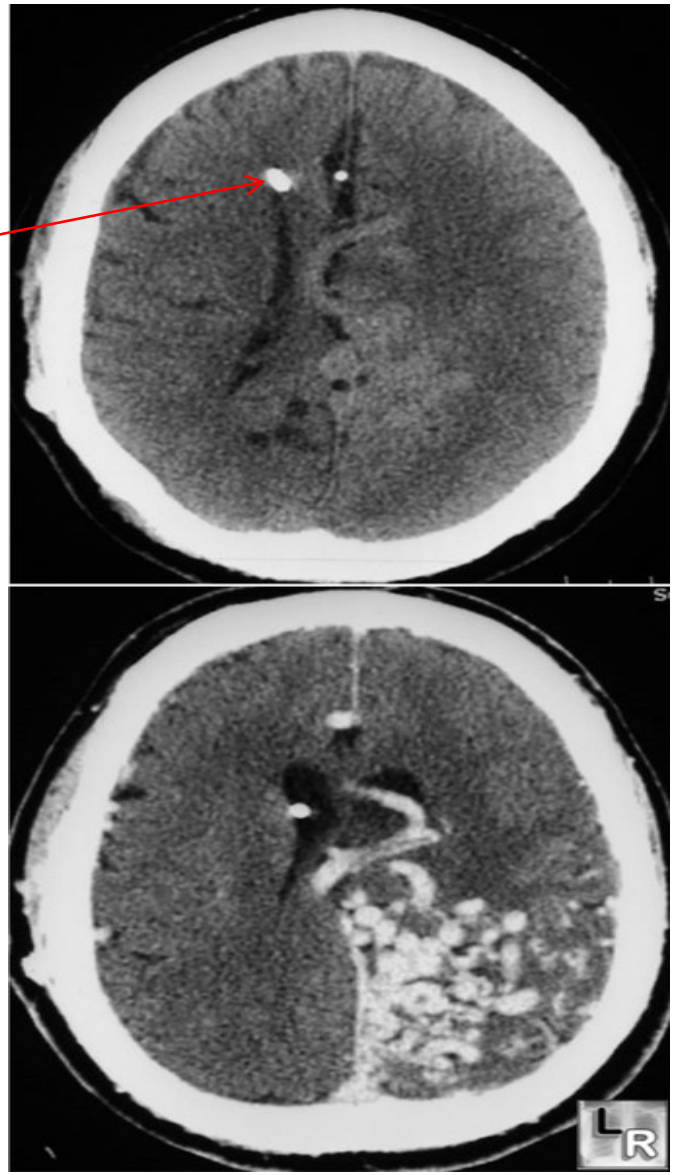
Cancer of the colon Double contrast barium enema shows an apple-core lesion surrounding the lumen of the descending colon. Courtesy of Jonathan Kruskal, MD.



Brain CT scan with contrast axial section

Calcification in choroid plexus

Calcification



Non-enhanced brain CT
Pre-contrast

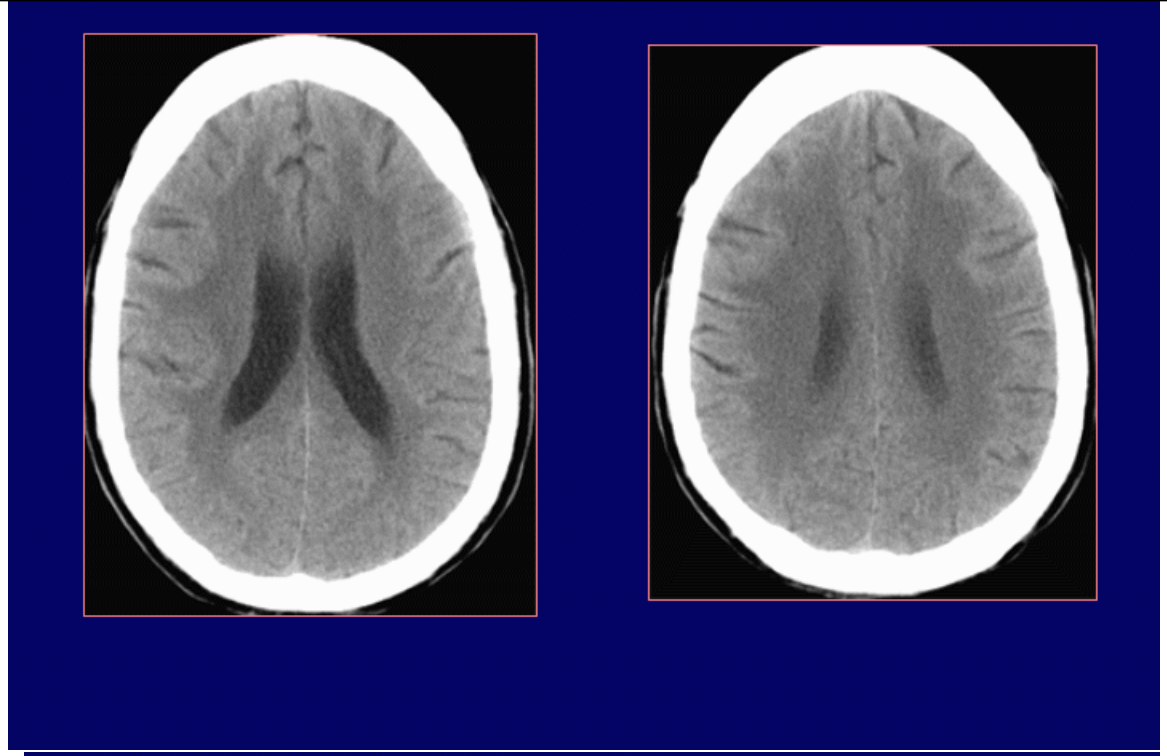
Enhanced brain CT
Post-contrast

vascular tumors

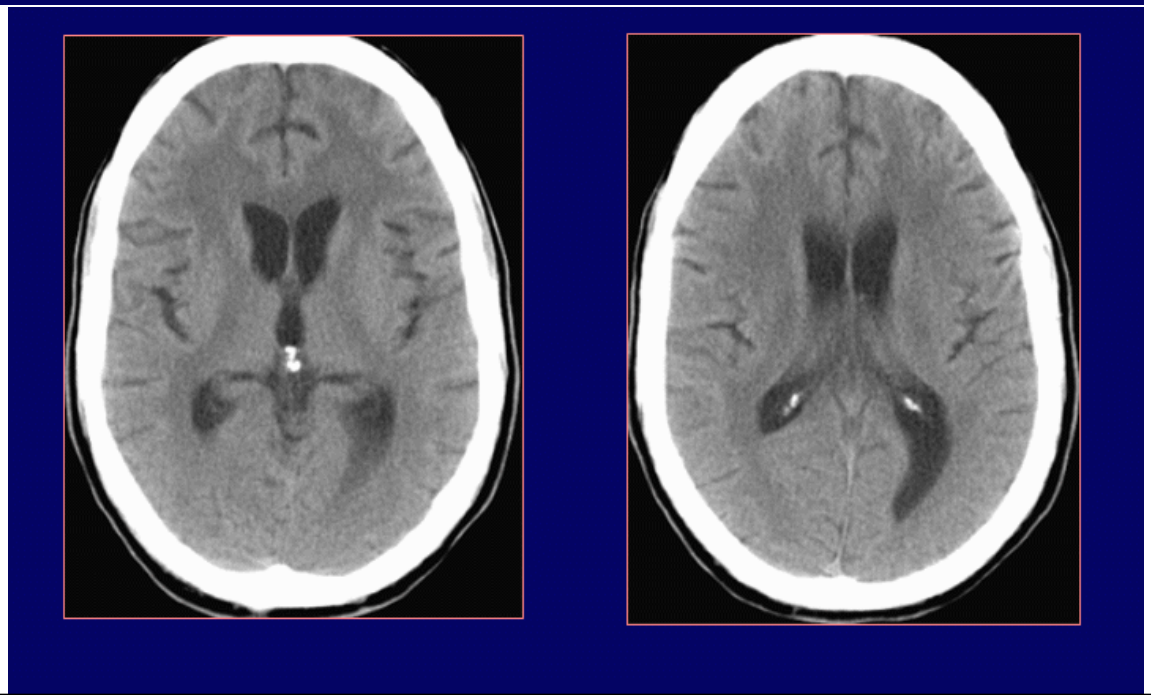
Rich of BVs, When I inject contrast → Enhancement

Aggrissive tumor → Bright كتير contrast بتاخد

Brain CT scan
without contrast

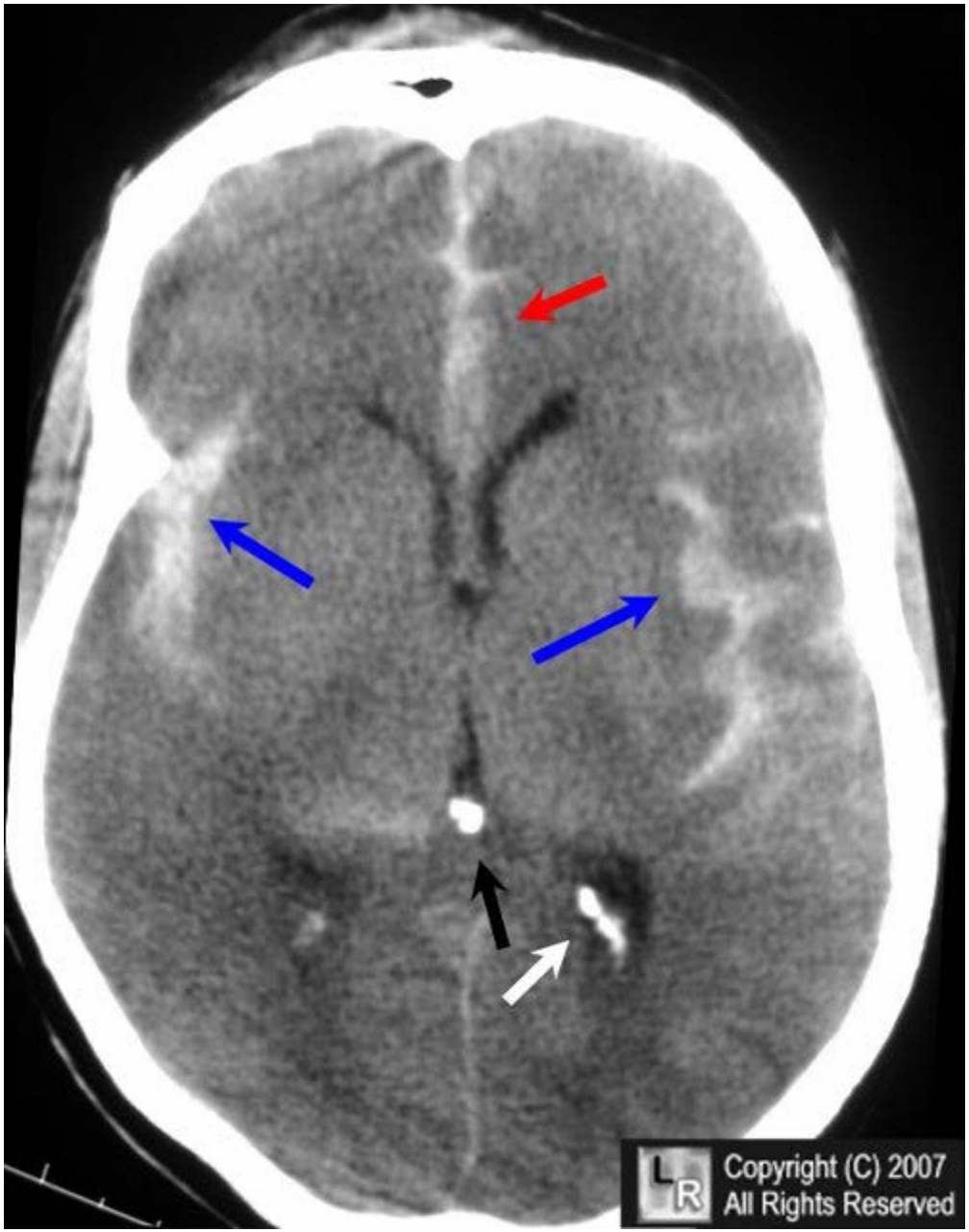


Pineal gland
calcification

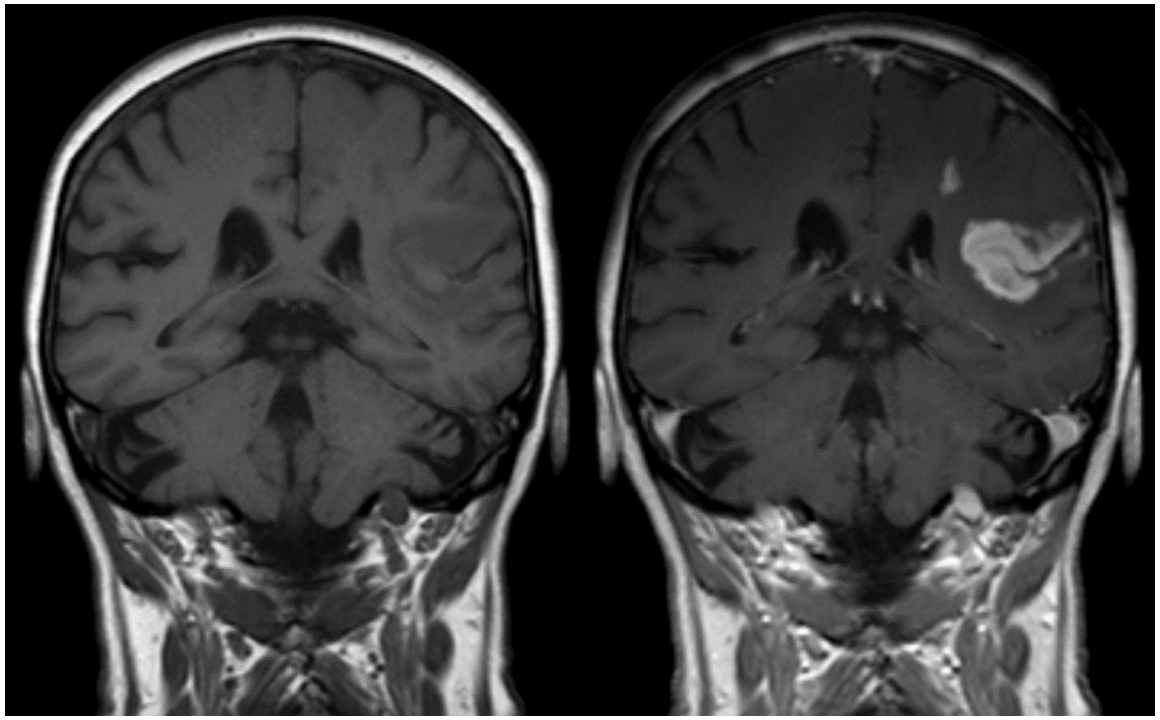


Non-enhanced brain CT

SAH



T1 MRI with contrast Post-Gd



* الـ Barium swallow بيختلف تركيزه عن الـ Barium enema ، حسب الـ procedure بيختلف التركيز

* مبدأ الـ Barium meal بردي إياها Concentrated أكتر حتى أضغط فيها بالمعدة

* We can use iodine oral, But usually we use it IV

* We use air as a negative contrast

* Barium & Iodine are pesitive contrasts

* مادة الـ density فيها أعلى ← أنا بحاجة أزيد كمية الأشعة.
يعني لما نستخدم Barium أو iodine بزيد كمية الأشعة.

* Negative contrasts : Air, CO_2, O_2, water

* Double contrast = gas

Indications of barium meals : Ulcers, Cancers, masses, stenosis, diverticular duoclenal ulcers,

* الـ Barium زي التراب، إذا نقص عليه هي بيصير يكتل زي الحجار ← بسكر بزيادة.
في الـ Obstruction

* 2 Types
1- Barium follow through → بنعطيه 2 glasses من الباريم
2- Barium endoscopy

Small bowel الباريوم بدخله مباشرة إلى ال

* Parts of duodenum ⇒ 1- Duodenal bulb
2- Descending part : ampulla of vater opens in it
3- Horizontal part (Transverse)
4- Ascending part

* The ligament of Treitz :- Connects both 3rd & 4rth parts of the duodenum as well as the duodenojejunal flexure.

Parts of the small bowel ⇒ 1 - Duodenum
2 - Jejunum
3 - ilium
4 - Terminal ilium
5 - Cecum.

Barium enema :- 2 types

1- Single

2- Double

* Inclications :- Amy problem in large bowel

* Follis Catheter or balloon enema → Enter to the rectum

→ Blow the balloon → folis بنثبت ال → Contrast بندخل ال

Cecum ال إلى حتى توصل Colon ال إلى

* These are done by the follow of flouroscopy

Parts of large bowel :- 1- Rectum

2- Sigmoid

3- descending

4- Descending flecture

5- Transverse

6- Hepatic flecture

7- Ascending

8- Appendix

9- cecum

* How to see the Ulcer :- Collection of barium in it

* Polip :- Area free of barium

---

* Contrainclications of using Barium IV contrast
  1- Allergies
  2- Renal failure
  3- Severe cardiac disease
  4- Severe renal disease
  5- Myeloma
  6- sickle cell anemia :- Diseased RBCs
  7 Bronchospasm.

* لازم يكون عندي في الغرفة معدات الـ emergency +

EN, Chortizone, Anticoagulants, Bronchial tube Oxygen, Bronchodilabors, Diazepem. anticepilepsy drugs

Urinary Tract procedures :-

→ Preparation : Laxative

IVU :- Intravenous pyelogram :- An x-ray examination to Kidneys & bladder

- Used in cases of renal pathology
- We put the catheter in the Cubital vein

* IV contrast → in 10 seconds it reaches the Kidney in glumerular system → We see nephrogram phase. In 5 minutes → Renal calyses
* In 10 minutes → In both ureters

كنا بنحضر المريض ← Relaxants

* When patient needs to go to bathroom → Contrast in the bladder

ومهم في ال adult patient أشوف ال Contrast لما يروح المريض عالحمام

* We see kidney (shadow) outlines in plane Kidneys because of fat around them

كمية ال Penetration لل Radiation لل fat أكثر من ال Renal tissue

ماذا يدخل في تركيب ال Film؟ ← الفضة ← حساسة للضوء وال Radiation

*لما يروح الـ Contrast على الـ Kidney أول شي بيوصل الـ glumeruli.

*ممكن لو الـ Kidney ما بينت ← Non visualized Kidney ← حتى نشوفها ← ① DMSA scan
→ function of kidney

② DTPA scan
→ Anatomy of kidney

Passive reflux → بس تتعبى لحاله بيطلع
Active reflux → بطلع بس يتبول المريض

*بعض المرضى بيعطيهم أنا مادة مشتقة زي الـ iodine

*I can't use uranium → It's Long half life :- تخيلوا واحد ماشي بالشارع بشع

Contraindication of IVU :- No Contraindications

* Using flouroscopy
MCUG :- Micturating cystourethrogram *Usually with children
proximal urethra بنستخدمها لـ

*Indications 1- If there's a reflux
female خصوصاً أذا ← 2- Recurrent infections (UTIs) → بخاف الـ infections تطلع لـ Kidneys ويصير Pylonephritis ممكن تخرب الـ Kidney لهذا السبب
during micturation بنستخدمها ← 3- Urethral pathology

*Contraindications → Acute UTI
Patient preparation :- Treat UTIs

Ascending Urethrography

for diagnosis of urethral injury or urethral strictures

بنستخدمها لـ distal urethra

In distal part of urethra there's a small fossa (fossa navicularis)

* بنحقن contrast في الـ urethra وبنصور

* Contra indications : infection.

Descending urethrography

Sialography : Radiographic examination of salivary glands

What are the salivary glands :- 1- Parotid
2- Sublingual
3- Submandibular

* بنقول للمريض ييجي صايم ويجيب معه ليمونة عشان يعمل Saliva لـ Secretion

* Indications :- 1- Mass
2- Södgren syndrome
3- Fouly excessive salivation → Caused by Stone
4- Stones, narrowing, Strictures ...

* Contrainchication :- Active Infection

Parotid ducts opens to the upper 2nd molar
submandibul duct opens to the frenium
sublingual ducts open in many areas sublingually

* بنوسح الـ duct تاع الـ parotid أو الـ submandibular، بندخل الكانيولا الصغيرة، وبنحقن الـ Contrast

Strensons
Warton's

Lacrimal duct :- Dacryocystogram

indication :- Excessive tearing (epiphoria) , Obstruction

* Contraindication :- Infection

* Lacrimal gland → Upper Lateral

* Lacrimal duct → lower medial

*الابتعاد عن مصدر الأشعة ، عدم التعرض لفترات طويلة -

Most sensitive organs for Radiation :- Bone marrow
- Gonads
- Thyroid
- eyes (Lenses)
- Breast

* Give the right indication for the right disease.
for the right organ

*Intessuption → Destended, Constipation

↳ If suspected → Reduction enema → Both diagnostic & Theraputic

Proximal go insid distal

- single contrast : only barium
- Double contrast : Barium with gas.

*Control film (x-ray) befor contrast

To see if there's perforation, ...

↓

air under diaphragm

Cholecystography

* المريض بياكل بيض مقلي (بيعطوه بيض)

بيصير Bile duct → Contraction الـ

بيتنزل الـ Contrast على

الـ Bladder ، بيرجع يعطيه كمان

وجبة دسمة ← بيصير Contraction

بيروح الـ Contrast على الـ Bile ducts

د على الـ duodenum

PTC : Percutaneous transhepatic Cangiogram

* micturating cystourethrogram (MCUG) in recurrent UTIs

 * To see reflux of bladdar or any urinary bladder abnormality

* Contraindications : acute infection.

* Patient preperation :- Treat UTI

Weak & scattered radiation :- ، هي اللي بتخوفني لأنه هي اللي بصير لها absorption -

HSG :- Hysterosalpingography :-

* Main indication :- 1- Infertility
2- Reccurent mischarages
3- Congenital abnormalities (shape of uterus)
4- Mass .

* We use low contrast

* Main contraindication :- Pregnancy , infections

↪ 9th or 10th day of period
* 10 day role ممنوع فحص المرأة المتزوجة إلا بعد التأكد إنها مش حامل

* HSG is not only diagnostic , it could be treatmen

ERCP :- Endoscopic Retrograde cholangiopancreatography

عن طريق الـ endoscope بندخل إلى الـ umpulla of vatar ←

Therapatic → بقص sphincter of odi وبنزل الحصاوي للـ bowel

indication :- Bancreatic / common bile duct problems

Contraindication: spasm, narrowing, bleeding

* liver contrast media : lipophilic

أصبح في التاريخ

* ŌCG → Oral cystogram

وبيجي المريض صايم وبيوخذ حبة

بيكون الـ GB مليانة، وبيصير امتصاص بتحصل للدواء ← بتروح من خلال

الأمعاء إلى الـ biliary system (بيصير لها) excretion في الـ liver بتروح على الـ GB)

* بنستخدم X-ray عادية، وبنشوف الـ GB مليانة contrast بيضة

بنشوف الـ size، بعدين بدنا ننزل المادة الملونة بنعطي للمريض

يأكل شي فيه fat ← بيض، جبنة، بحتوي لإيجيد لن GB contraction

Muscular relaxation of stomach → Spasmogram

↳ Contraindication → Benine prostatic hyperplasia

Arteriogram + Venogram

- Indications :- Vessel disease , stenosis , stricture , annewrysm , DVT

- Contraindication :- Relative to contrast media
→ We use MRI

أصبحت تاريخ

Arthrogram → Sholder , hip , Knee → معظمها -

* بنحقن ال Contrast داخل ال joint وبنعمل حركات
بنلف رجله يمين ، شمال حتى ينتشر ال Contrast

* Biopsy under guidance of ultrasound , x-ray , ...

Principles of imaging modalities

Dr. Jehad Fataftah
Consultant Interventional Radiologist
PRINCE HAMZAH HOSPITAL

Q: What is the most common Ca. associated with the radiology? Ans: leukemia (bone marrow) then lymphoma then thyroid → testis/ovaries → liver, kidneys (internal organs) → (less) lungs → skin, MSS, nervous system.

Principle imaging modalities in diagnostic radiology

- Plain x- rays
- Digital radiograph
- Fluoroscopy / Screening
- Ultrasound
- Computed tomography (CT)
- Magnetic resonance imaging (MRI)

Digital radiography (DR) is an advanced form of x-ray inspection which produces a digital radiographic image instantly on a computer.

The attenuation coefficient is a measure of how easily a material can be penetrated by an incident energy beam (e.g. ultrasound or x-rays).

What are X-rays

- X-rays are electromagnetic radiation that can penetrate the body to allow non-invasive visualization of the internal anatomy.
- X-ray was discovered by the german physicist Wilhelm Conrad Roentgen in 1895.

https://geekymedics.com/the-basics-of-mri-interpretation/

Plain films

Are produced by the passage of an x-ray beam through the patient and exposing a radiographic film.

Plain films are particularly used for:

- Chest.
- Abdomen.
- Skeletal system: skull, spine, trauma, joints.

Digital radiography

- In digital radiography, the basic principles are the same but a digital screen replaces the x-ray film.
- The information on the screen is then manipulated via computers and the image is visualized on a monitor.

Fluoroscopy

بستخدمها عشان اشوف اذا في abnormality بال organ movement

- Is the term used when a continuous x- ray beam is passed through the patient to produce a moving image that can be viewed on a monitor.
- Many different procedures, such as barium studies, arteriography and interventional procedures are monitored and carried out with the aid of fluoroscopy.

Ultrasound

عبارة عن امواج صوتية بتطلع وبعدها بترجع وبتطلع ع الشاشة

- Is a method of imaging that uses high frequency sounds waves beyond the range of human hearing to image structures inside the body.
- Ultrasound is non-invasive, which means it does not penetrate the skin or body openings .

Doppler ultrasound

- Is a technique to examine moving structures in the body.
- Doppler ultrasound study the motion and velocities of blood flow.

It is utilized for:

- Assessment of cardiac chambers and heart valves.
- Arterial flow studies, especially carotid and peripheral vascular disease.
- Venous flow studies for detection of deep vein thrombosis.

Advantages of ultrasound

- Relatively low cost of equipment.
- Does not expose patient to radiation.
- Non-invasive.
- Widely available.
- portable equipment can be taken to the bedside of ill patient.
- Scanning can be performed in any plane.

Computed tomography (CT)

- Is a technology that uses a number of x-ray beams, a set of electronic detectors and a computer to generate multiple cross sectional (axial) images.
- Any portion of the human body can be imaged by CT.
- Oral contrast (Gastrografin) is used to outline the gastro-intestinal tract.
- Intravenous contrast is also used to delineate the vascular system and to study organ enhancement in various pathological conditions.

Magnetic resonance imaging (MRI)

The MRI is a technology that utilizes three primary sources to generate the images:

- Magnetic field
- Radio waves (radio frequency pulse).
- Computers.

Magnetic resonance imaging

- The basic of MRI is to direct radio-waves at protons in the nucleus of hydrogen atom.
- By applying a pulse of radio-frequency, the protons are excited and moved out of alignment with the magnetic field to some degree(90 degree).
- The protons are alternately excited and relaxed.
- Each time the radio-pulse switches off, the Protons go back to their original position (relaxation), they emit signals, that are processed by a computer program to form image.

Magnetic resonance imaging /2

MRI is the technique of choice for imaging

- Central nervous system: brain and spine.
- Musculo-skeletal system: tendons, ligaments, and muscular abnormalities.

Advantages of MRI

- Can image in any plane: axial, saggital or coronal.
- No ionizing radiation
- Excellent anatomical detail.
- Visualized blood vessels without contrast: MRA and MRV.

Disadvantages of MRI

- High operating cost.
- Fresh blood in recent hemorrhage not as well visualized as by CT.
- Inability to show calcification with accuracy.
- Contraindicated in patients with pacemakers, metallic foreign bodies in the eye and arterial aneurysmal clips.

Contrast media

- Contrast agents are substances that assist visualization of some structures during radiological procedures.
- The most commonly used are barium sulfate to outline the gastro-intestinal tract, and organic iodine preparations which are widely used intravenously in CT for vascular and organ enhancement.

Oral ⇒ barium sulfate, gastrografin
IV ⇒ organic iodine

Contrast media / 2

Organic iodine preparations are also used in:

- Angiogram : the arterial system.
- Venogram : the venous system.
- Uorogram : for renal tract.
- Myelogram : for the spine.
- Hysterosalpingogram : uterus and fallopian tubes.
- Arthrogram : for joints
- Sialogram : for salivary glands.

Allergic reaction

The risk of allergic reaction with the use of contrast is increased in those with:

- history of allergy.
- bronchospasm.
- cardiac disease.
- elderly patients.
- neonates.
- diabetic patients.
- Patients with multiple myeloma.

- history of

Allergic reaction / 2

Three types of contrast reaction

- **Minor reaction:** nausea, vomiting, urticarial rash.
- **Intermediate reactions:** hypotension, bronchospasm
- **Major reaction:** convulsions, pulmonary edema, arrhythmias, cardiac arrest.

Allergic reaction / 3

Drug therapy should be readily available to treat reactions:

- Urticaria: chlorphenaramine or other antihistamine .
- Pulmonary edema: frusemide iv.
- Convulsions: diazepam iv.
- Bronchospasm: hydrocortisone iv. and brochodilators.
- Anaphylactic reactions: adrenaline s.c or iv.


Thank
You

Brain → Supratentorial
→ infratentorial

NEURORADIOLGY

↳ 2 types → Brain imaging
→ Spine imaging

* Deeply seated gray matter
  1- Nuclei
  2- Thalamus
  3- Basal ganglia.

Dr_Khalil .Abo oura
Dr_Ahmad .Abuain
Radiologest .PHH

* We have many modalities for radiology → x-ray
→ CT scan
→ US
→ MRI

2 types of radiation in diagnostic → Ionizing radiation → x-Ray, CT (Harmful)
→ Non-ionizing → MRI, US

* We will see the use of each modality in brain imaging

Eman Humaidat

4 ventricles: 2 lateral ventricles, connected to the 3rd by the foramen of monro.. 3rd & 4th connected by cerebral aqueduct of sylvius

White matter connecting 2 hemispheres: corpus callosum (rostrum, genu, body, splenium)
WM

CT: you take axial, then reconstruction on the computer to get coronal section
MRI: multiplanar: axial, sagittal, coronal.. (T1, T2 or FLAIR)

Conventional angiography is invasive (like heart catheterisation), it's the gold-standard but is invasive..
So, Angiography using CT or MRI are good substitutes + are non-invasive

Ultrasound: hypo- (أسود) or hyper- (أبيض) echoic (hyper is bright, hypo is dark)
X-ray: radio-opaque or radio-luscent
CT: hypo- or hyper- dense (bone is hyper-dense , white.. While fluid is hypo-dense)
MRI: signal intensity… ← density في الـ CT بنعلق على الـ

T1>> fluid is hypo-intense (black), WM is white, GM is grey
T2>> fluid is hyper-dense (white), WM is grey, GM is white
FLAIR>> same as T2 but fluid is black (Fluid-attenuated inversion recovery)

Only for fractures or bony lesions ←

* X-ray has a limited role in brain imaging → We can't assess the brain tissue , Only bony tissue (skull) can be assessed

* CT is better than x-ray as it's intense x-ray CT = 400 x-ray → More resolution
↳ Better to use in skull → Because there are many overlaps

*If a traumatic patient came with skull fracture & we asked for skull x-ray & it was frank (ويل) we ask for other investigations like CT or MRI because usually skull fracture is associated with other things, eg:- Hemorrhage which can't be assessed with x-ray So we have to use CT-scan in a case of trauma to look for other associated pathologies.

So

* X-ray:- Has a minor role in brain imaging, just used for skull fractures or bone lesions
  - *In the past it was used for sella turcica assessment or in calcifications in general (Before CT & MRI)
    → enlarged sella turcica → Tumor
  - But with the presense of CT & MRI now X-Ray has no role

* In Ultrasound:
  * There's a prope → Produces sound waves → Pentrate parts of the body according to the density -
  different densities in body → reflection
  * الصورة اللي بتطلع عنا هي عبارة عن
  Reflection
  Partial reflection
  No reflection at all
  Complete reflection → Bones

Bones prevent sound waves to penetrate it → You can't see anything beyond the bone

* The only use of ultra sound in brain imaging is in neunates
  Because we have a window to see through (Fontanells)
  still open

Other use of ultrasound in brain imaging, which is indirectly, is the assessment of carotid arteries in the neck which are the main arterial blood supply to the brain

Neuroradiology

- Neuroradiology is a subspeciality of radiology focusing on the diagnosis and characterization of abnormalities of the nervous system, spine, head and neck.
- The imaging modalities include:

- **Plain radiography**
- **CT scan**
- **MRI**
- **Angiography**: is being replaced in many instances by MRA
- **Ultrasound:** is used in limited circumstances.

Neuroradiolgy / investigation

Plain film

The plain skull film may reveal:

- Calcification
- Pituitary fossa enlargement
- Bone lesion or secondary deposit.
- Fractures

■ In macroadenoma >1cm .. may cause bone erosions
■ Bone lesions : as in pts of multiple myeloma→ on lateral skull x-ray we may see bone lesions

Very limited role in imaging the brain
We can use X-ray to rule out fracture but we typically use CT scan since it gives a clearer picture about the injury

ULTRASOUND

- The neonatal brain can be scanned through the open anterior fontanelle for:
  - Hydrocephalous
  - Interventricular or intracerebral hemorrhage
  - Suspected intracranial pathology.
- Doppler studies are used for the diagnosis of carotid artery stenosis.

Neonates have the ant & post fontanelles + the mastoid process is cartilaginous – not ossified

★ craniosynostosis : when the sutures or the fontanelle are prematurely closed in infants before the full formation of the brain

★ Treatment by opening the sutures, to allow the baby's brains an adequate space to grow and develop.

★ Doppler for carotid artery : in elderly a calcifications in the carotid artery occurs which lead to narrowing or stenosis in it

*CT-scan in brain imaging :- We can asscess bone & soft tissue
↓ Bone integrity
↓ Cerebral tissue

*More resolution than X-ray

- Rule :- CT scan is used for acute events in brain hemorrhage
  — Trauma , RTA , falling down , stroke-like symptomes

*Stroke is a clinical not an imaging diagnosis

*A patient came & diagnosed with stroke (Before starting treatment we have to know if it's hemorrhagic stroke or ischemic stroke) I have to exclude hemorrhage to start treatment by CT

↳ The modality of choice → faster → More available

*كل المستشفيات فيها بس CT مافيه MRI في كل مكان

*In detecting or localizing stroke , MRI is better than CT but we use CT :
↳ To exclude Hemorrhage

*CT can not see stroke or ischemic changes in first 6 hours

*احنا مابدنا نشوف ال stroke ، احنا بس بدنا نشوف Do we have hemorrhage or not to start treatment

CT scan for acute events , MRI for anything else → Tumor , white matter disease , Meningitis , Vasculitis ... etc.

CT and MRI

- CT is especially valuable in acute head injury (recent brain hemorrhage), stroke, and suspected subarachnoid hemorrhage.

In acute emergencies, CT is used rather than MRI bcz of it's availability, cost-effectiveness, rapid results + CT is enough in most acute cases

((CT scan doesn't show ischemic changes in the first 6 hrs)) Usually CT is normal →
BUT even in ischemic stroke, CT scan is important to exclude haemorrhage (helps the physician to decide whether it's ok to give anticoagulant..) … we can use MRI later for the characterisation of the infarction

- MRI scan demonstrate the brain using a multiplanar facility in axial, coronal, and saggital planes, with excellent views for the posterior fossa.

Use CT for detection of haemorrhage in acute events, MRI for anything else… tumours, localisation & timing of ischemic strokes, pituitary lesions >> MRI is better

CT and MRI / 2

MRI is superior to CT in:

- Lesions of the pituitary fossa.
- Spinal cord abnormalities.
- White matter disease.
- Demyelinating plaques in multiple sclerosis.
- Differentiation of grey and white matter.

MRI indication:
Lesion in pituitary fossa :MRI for pituitary >>sagittal T1 with and without contrast

MRI is a multiplaner imaging with multiple sequences

CT-scan, axial, normal…
Bone is hyper-dense → White
Fluid is hypo-dense → Black

Fluid → Hypodense
Bone → Hyperdense

In brain &
GM → Peripherally
WM → Centrally

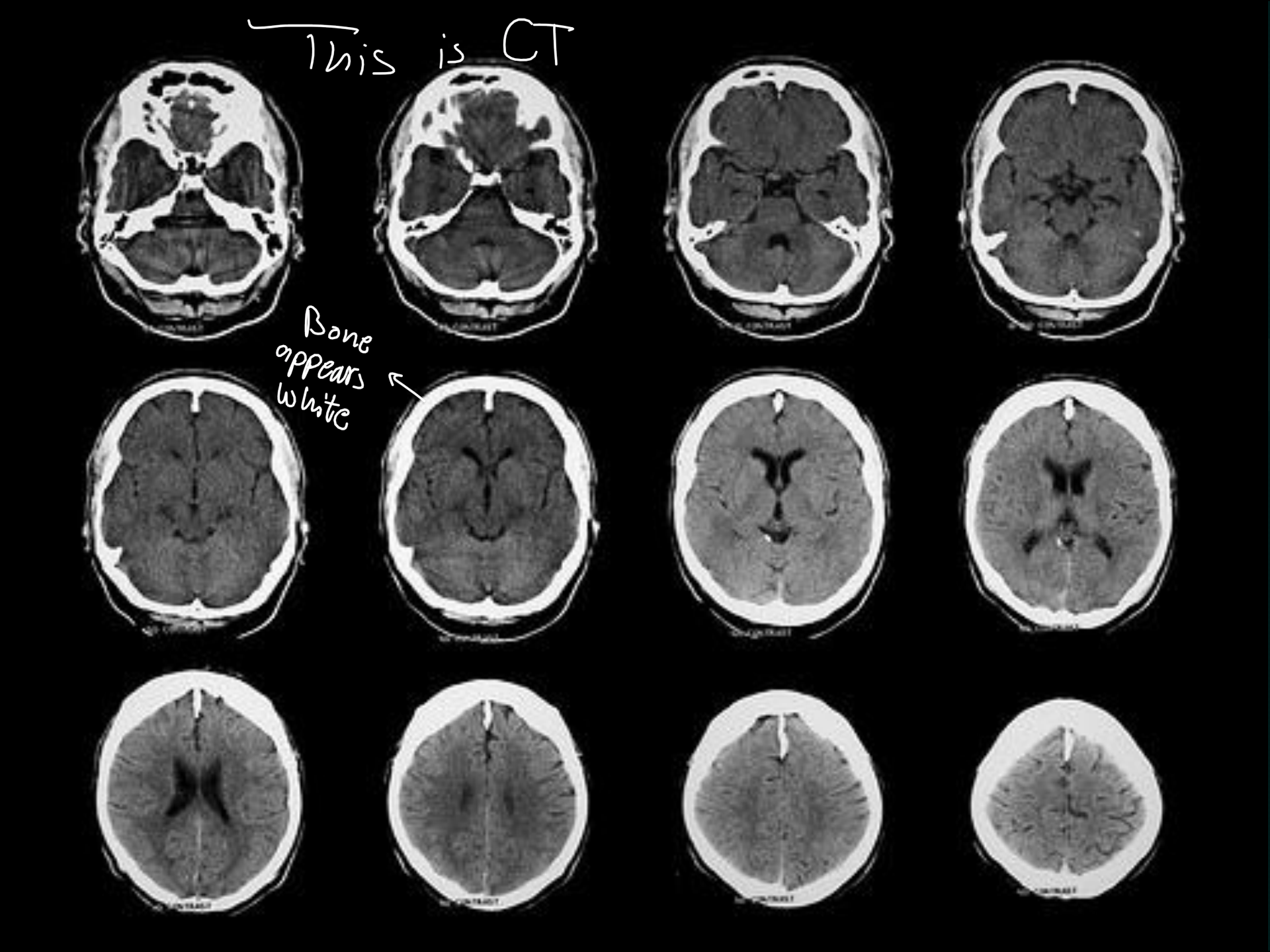
In spine &
العكس

In brain &
we have deeply seated GM
- Basal ganglia
- Thalami

In CT-scan
GM → Hyper-dense
in relation to WM

* differentiation between GM & WM is not that clear in CT

* In MRI → High resolution or high differentiation between GM & WM


This is CT
Bone appears white

Normal MRI, axial

MRI is a multisequance modality while CT is a 1 block

T1...
WM is white
GM is grey
Fluid is hypo-intense (black)

T2... كل شي عكس T_1
WM is grey
GM is white
Fluid is hyper-intense (white)

FLAIR... T_2 with attenuation of fluids
WM is grey
GM is white
Fluid is hypo-intense (black)

- Structural MRI (Anatomical) → Structrure بصورنا ال → T_1 , T_2 , FLAIR → signal intensity بيعطونا الأبعاد ، ال وين موجود كيف شكله
- Functional MRI → Metabolites within the cerebral tissue → Diffusion
  → Spectroscopy

Angiography :: imaging of blood vessels

* Part of the interventional radiology

* Conventional angiography :- invasive procesure done by interventional radiologist to image blood vessels

Ressembles cardiac cath

* It's used for assessment of blood vessels related pathologies
  - Anneurysms, AV malformations, AV fistulas, Blood vessels malformations
* Nowadays it's used for stroke treatment if it was within the window
  * If patient came within 3 hours of onset
  * If CT or MRI chriteria achieved
* We go inside the artery & extract the thrombus

CT or MRI angiography

* مع التطور في ال CT وال MRI عملوا شيء اسمه
  * Non-invasive procesure
  * We image blood vessel using CT & MRI without surgical intervention
  * 90% of cases can be diagnosed with CT or MRI angiography
  * Largely replaced conventional angiography (we use conventional only for treatment)

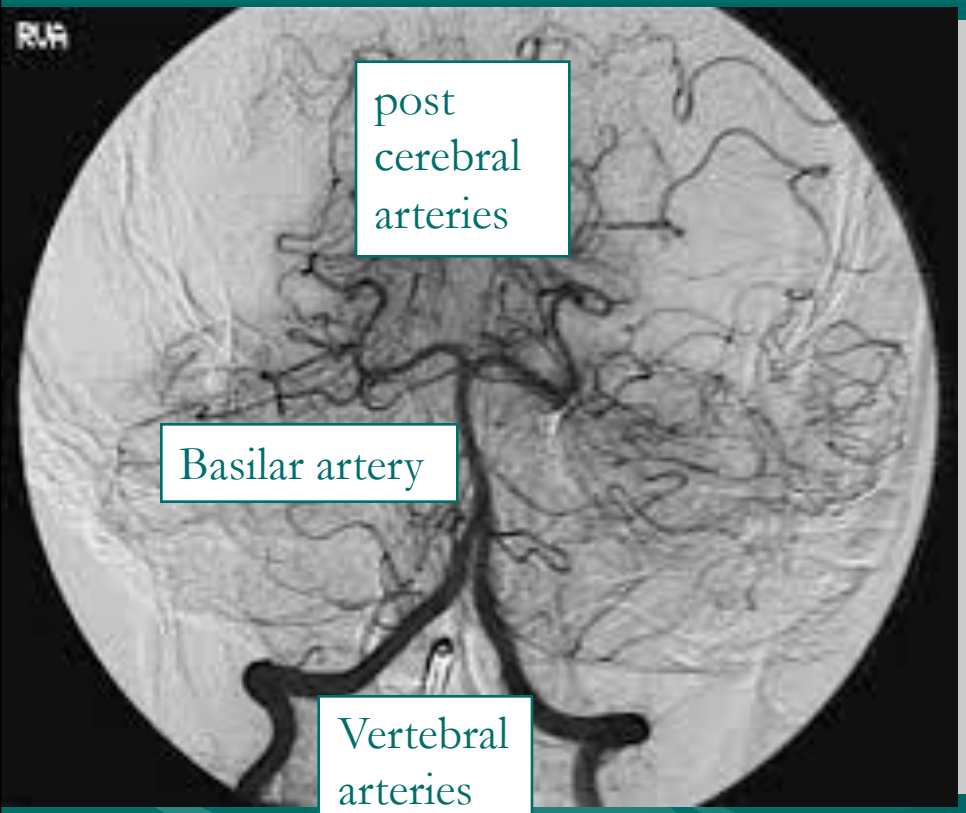
Arteriography

→ Part of the interventional Radiology

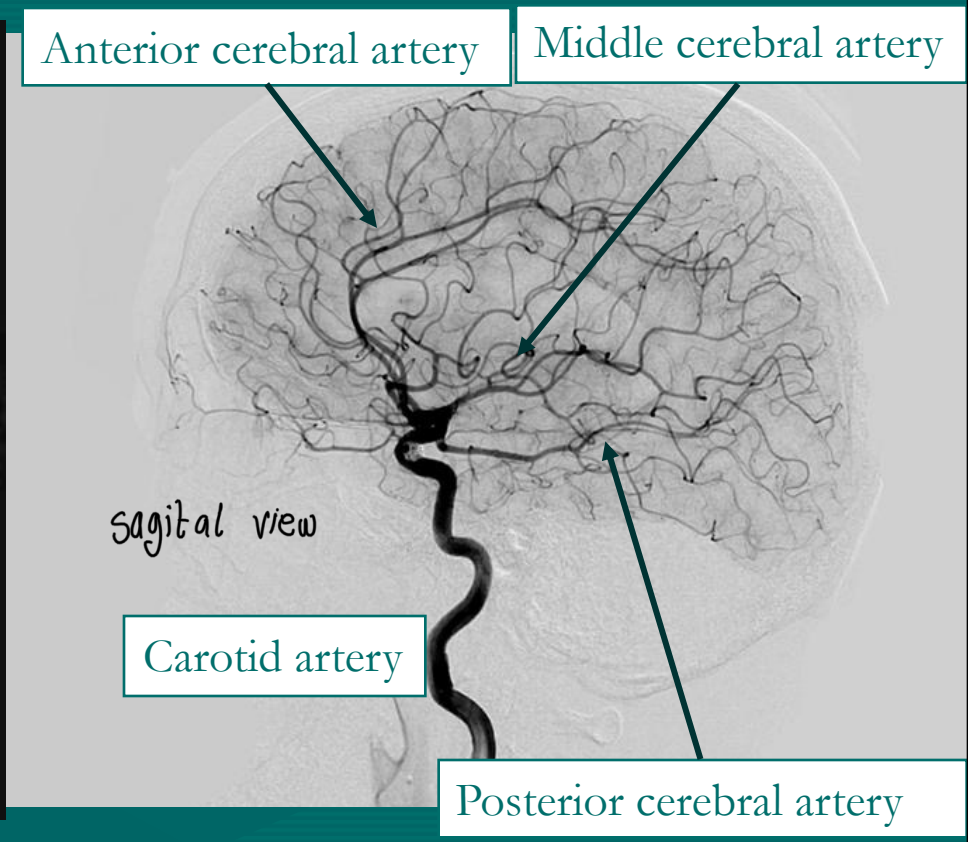
- Cerebral angiogram is useful in evaluation of aneurysm and arterio-venous malformations.
  - Arteriography … if I suspect brain aneurysm or AVM
- CTA and MRA demonstrate cerebral arterial and venous circulation and has replaced conventional angiography in many situations.

MRA can be used without contrast

The posterior circulation – coronal plane



Sagittal plane

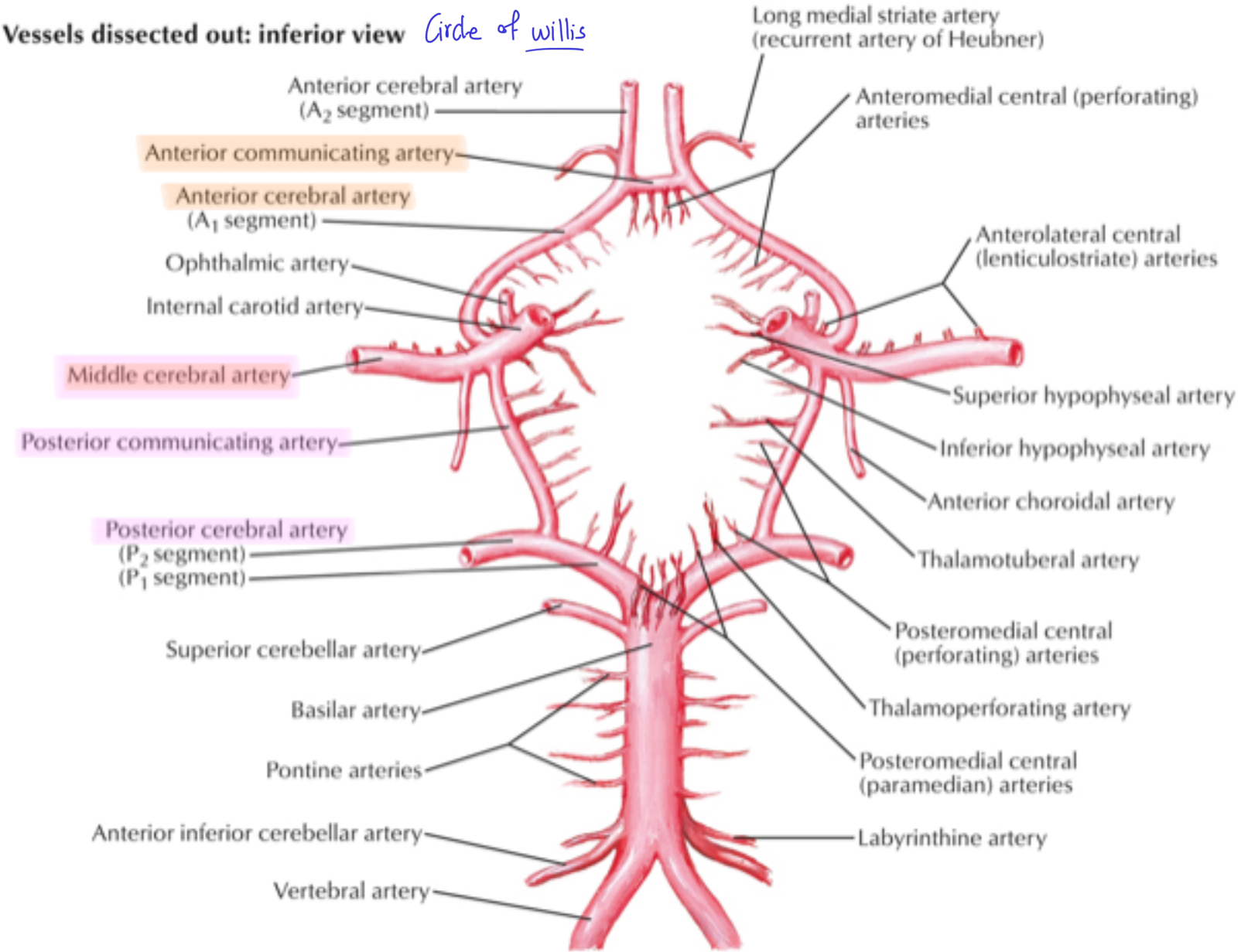


Blood supply to the brain

- Posterior circulation
  - From vertebral arteries
    - Basilar artery
      - 2 posterior cerebral
- Anterior circulation
  - From carotid arteries
    - Anterior cerebral
    - Middle cerebral

Circle of willis can only be seen on transverse plane

Vessels dissected out: inferior view Circle of willis



BRAIN infarction

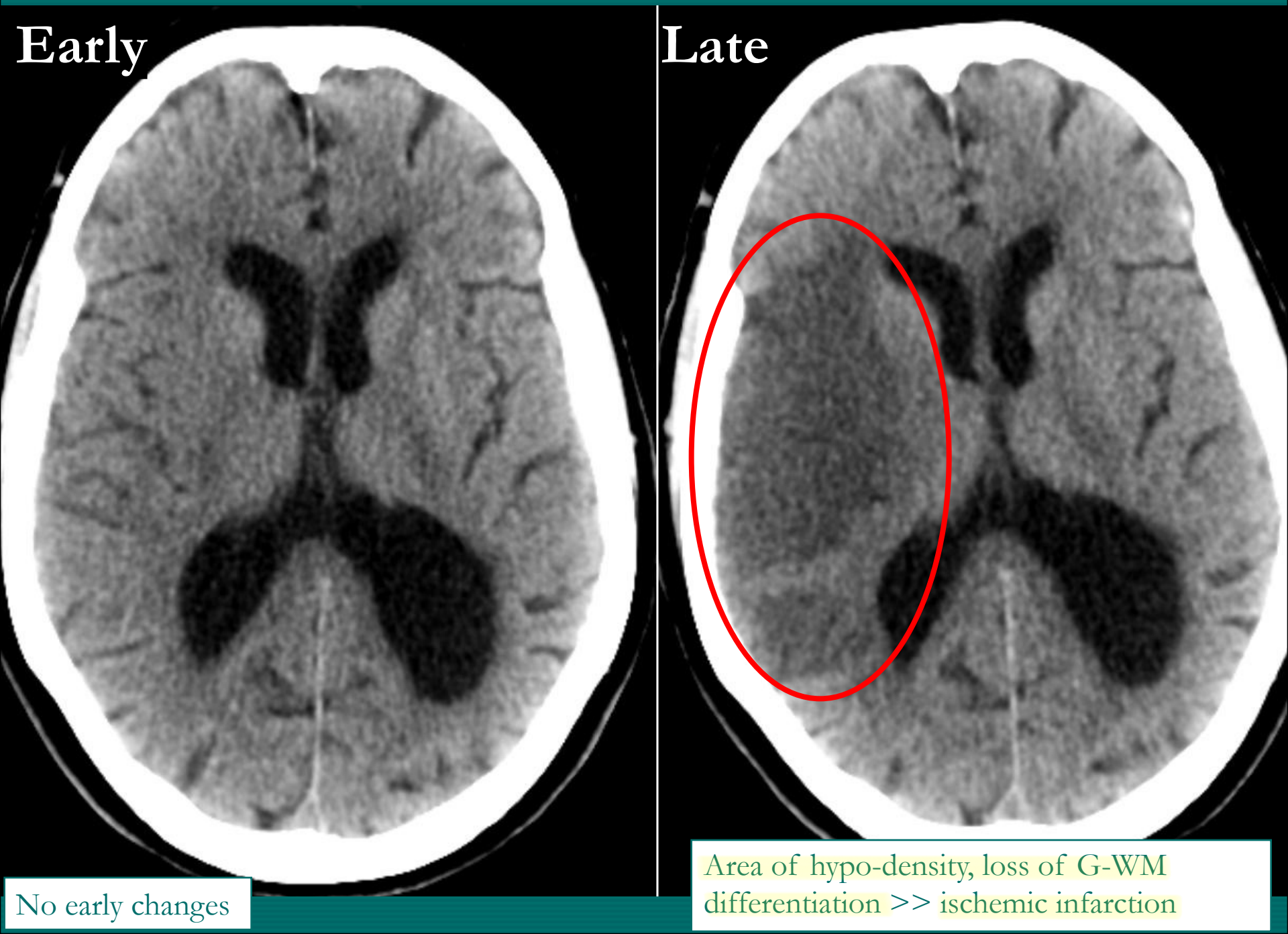
Loss of blood supply to general or localized specific area to the brain due to blockage of the artery supplying this area

- Ischemic infarction of the brain result from interruption of the blood supply to a portion of the brain. usually primarily produced thrombus in that place or Emboli ←
- The main sign of infarction is an area of decreased attenuation (hypodense) within the cerebral substance with effacement of the adjacent sulci. area of hypodensity with loss of Gray-White matter differentiation
- **Hemorrhage** may develop within the infarct, (about 10-15%), and is seen as an area of hyperdensity.

Haemorrhagic transformation>> stop the anticoagulant

Brain oedema involving the grey matter >> enlargement of GM >> loss of grey-white differentiation

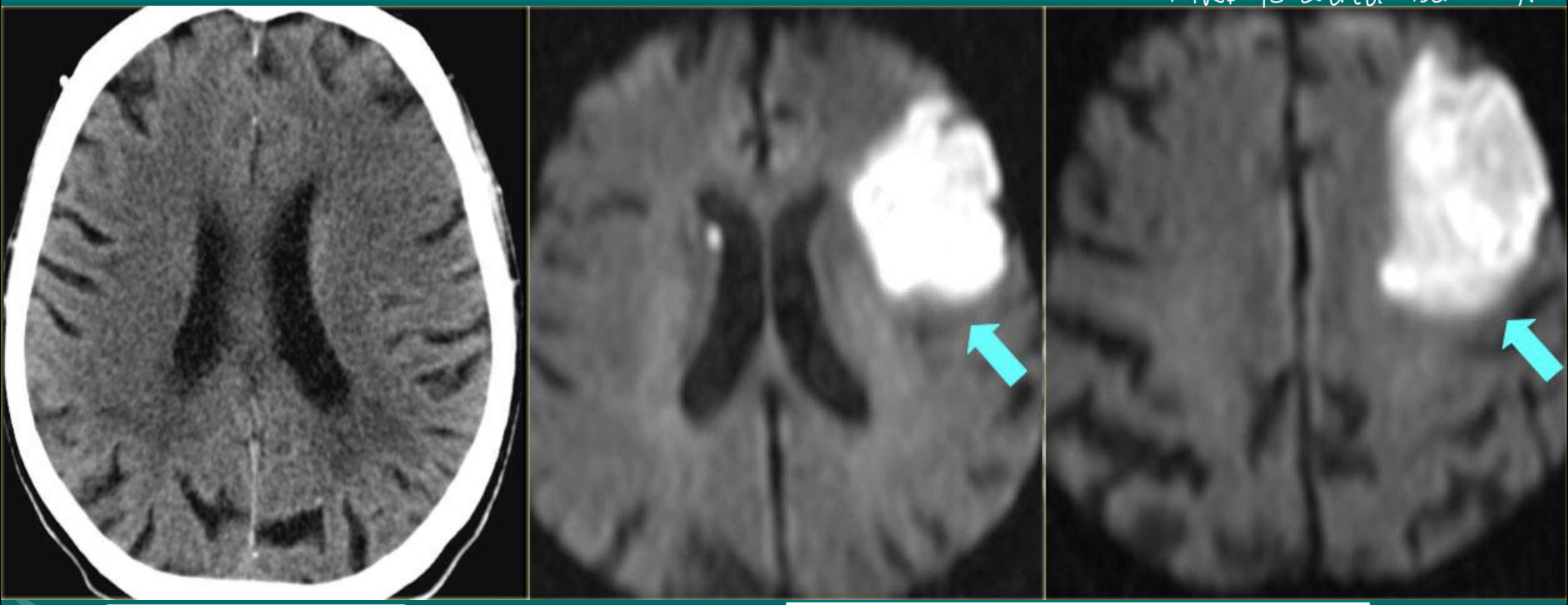
Usually, the brain responds to triggers by oedema..
Ischemic infarction >> oedema >> hypo-density on CT (but these changes are late, appear after 6hrs..)
So, ischemia is hypo-dense while haemorrhage is hyper-dense


Early
Late
No early changes
Area of hypo-density, loss of G-WM differentiation >> ischemic infarction

CT vs Diffusion

Can detect acute ischemic infarction

The best sequance in the MRI to detect ischemic NP



No early changes on CT

* After 6 hours → Hypodensity + loss of Gray-to-White matter differentiation

Diffusion is the most sensitive MRI sequence for detection of early ischemic changes (within minutes) >> shows areas of hyper-intensity

Important note

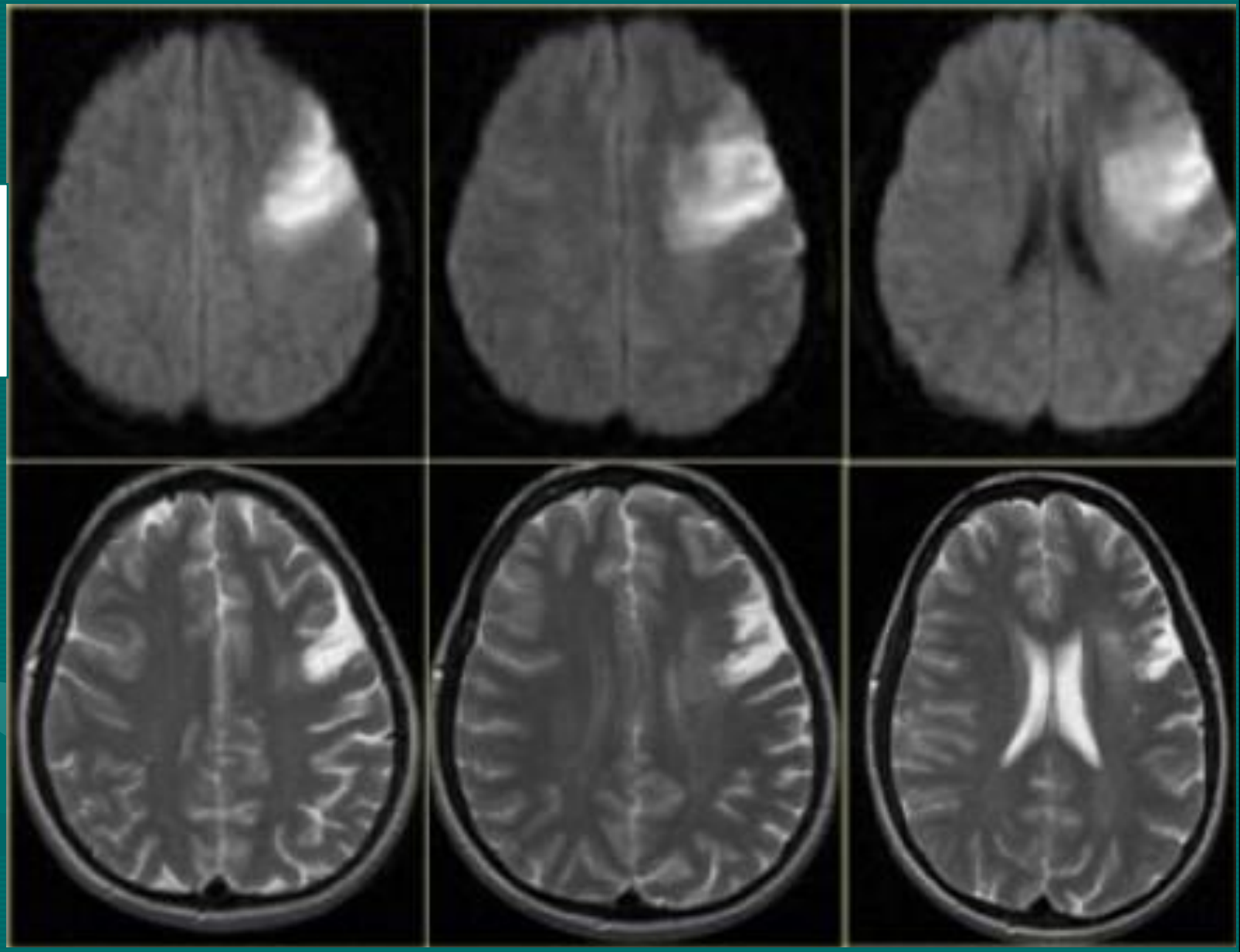
* Hemorrhagic transformation into the affected area
* Associated with HTN

*MRI is better than the CT in detecting ischemic stroke

*The best sequanse in the MRI to detect ischemic stroke is diffusion

Diffusion

Very clear ischemic changes within mins



T2

Minimal early changes

Small arteries (like perforators/thalamo-striate arteries) >> small infarcts

Lacunar infarction

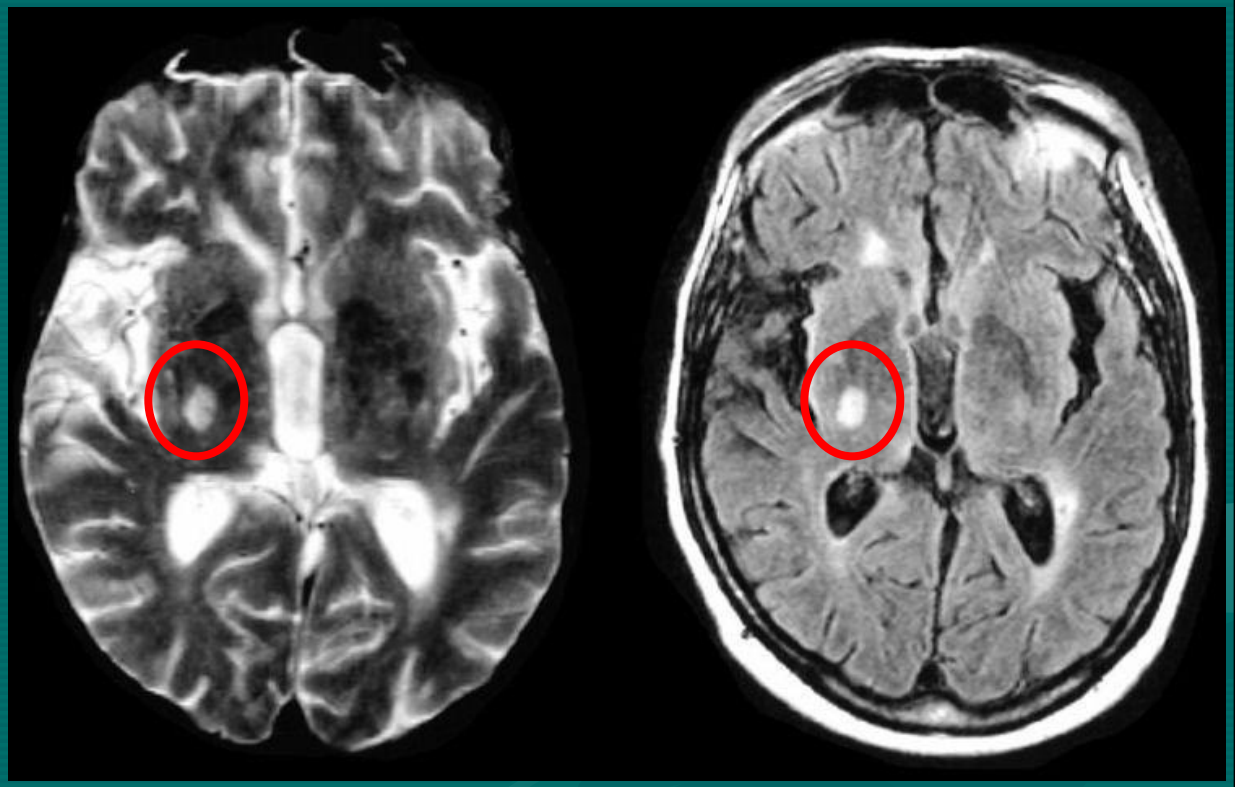
→ Because arteries involved are deeply seated

- Lacunar infarcts are small, deep cerebral infarcts, occur as a result of occlusion of small distal intracerebral arteries. small arteries
- Lacunar infarcts are usually less than 1cm in diameter and appear in the region of the internal capsule, basal ganglia, thalamus and brainstem.
- Lacunar infarcts are commonly seen in patients with small vessel disease.

Small vessel dzs: HTN/DM/small vessel vasculitis

Vessels are week, fragile → easily occluded or ruptured

CT scan.. Late ischemic changes



MRI diffusion ??

CT and MRI in brain infarction

Why CT is the modality of choice for the initial evaluation of stroke ?

- CT is superior to MRI in detecting recent brain hemorrhage, and the role of CT is to exclude the presence of intracerebral hemorrhage, because the treatment of an infarct will differ depending on whether hemorrhage is present or not.
- MRI is superior and more sensitive than CT in the evaluation of any kind of edema and for the detection of acute infarction

hyperdense ← CT بيبين على الـ

Brain hemorrhage

- Intracerabral hemorrhage:

  Is bleeding in the brain caused by rupture of a blood vessel.

Usually takes the shape of the structure affected

- May occur in any part of the brain, but the frequent sites are: basal ganglia, thalamus and cerebellum.
- A third of intracerebral bleeds result in intraventricular hemorrhage.
- **Most common causes are:**
  - Chronic hypertension
  - Rupture aneurysm or arterio-venous malformation

Hemorrhage is characteristic in HTN

Usually affects basal ganglia, brainstem, cerebellum.., Pons
Usually taking the shape of these structures

You need to determine the cause for the management
HTN >> treated medically
Aneurysm/AVM >> treated surgically

On CT scan >> haemorrhage is hyper-dense acutely, (hypo-dense later?) لأن الدم بتحول fluid..

*In intracerebral Hemorrhage → Treatment is decompression surgery → عشان skull يشيلوا جزء من الـ Brain ← Herniation يصير

BRAIN HEMORRHAGE

Hemorrhage within the cerebral tissue is intracerebral hemorrhage

بلشنا من الخارج إلى الداخل -

Brain tissue is the cerebrum

sorrounded by menanges

1- Pia matter
2- Arachnoid matter
3- Dura matter

then periostium → The skull

* According to region, It's devided into:-

1- Epidural hemorrhage : in most of the cases associated with trauma

* dura matter الـ بتربط بأطراف الـ sutures تكات الـ skull bone

Dura matter :- Covering menenges that attach the sutures, so it doesn't cross the sutures

* Hemorrhage within epidural space is localized between the 2 adjecent sutures & doesn't cross them.

* Usually result from arterial blood.

High flowing blood

→ Bulging on the brain

*Lenticular shape Bicomex

* Hyperdensity (Acute)

* Area between skull & Dura matter

↳ is called epidural space

↳ Hemorrhage within this area is epidural Hemorrhage

* Area between dura & arachnoid

↳ is called subdural space

↳ Hemorrhage within that space is subdural hemorrhage

* Area between pia & arachnoid is called subarachnoid space

↳ Hemorrhage within that space is Subarachnoid hemorrhage

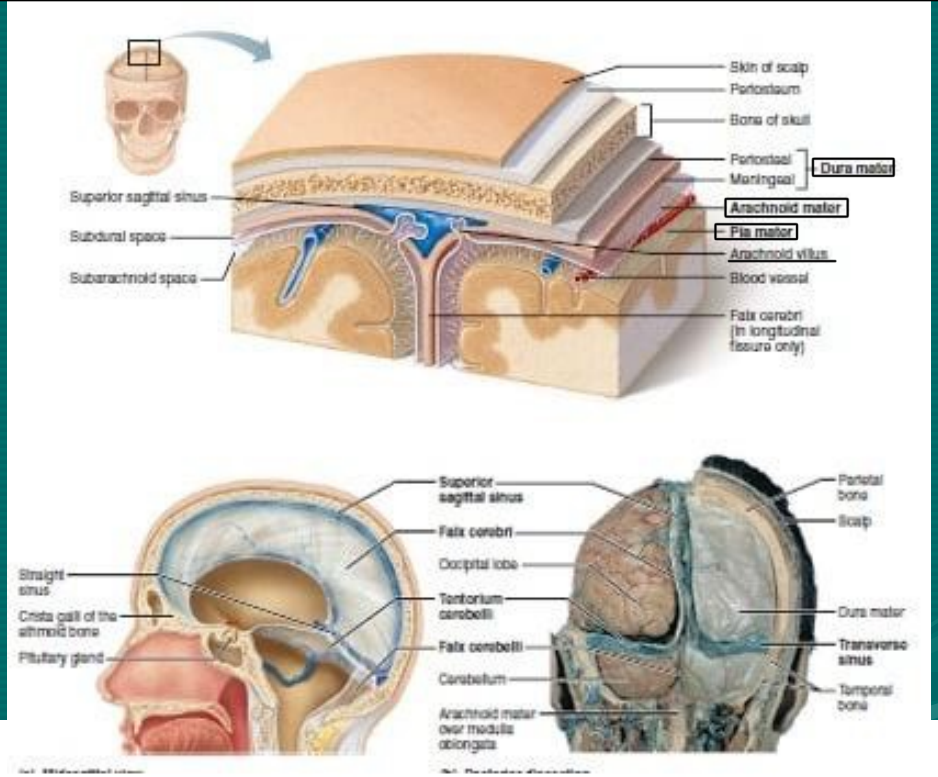
• Intracerebral hemorrhage

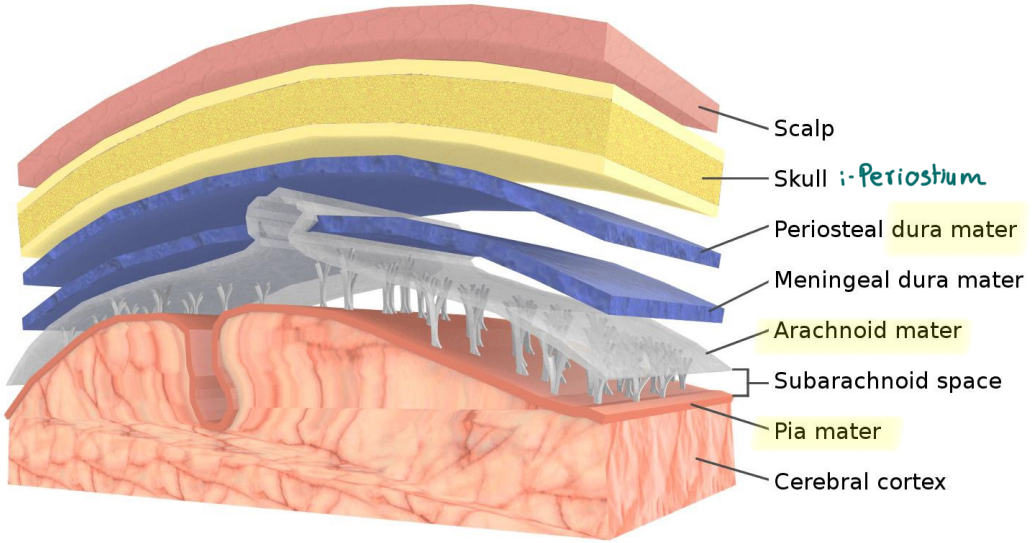
CT scan
Haemorrhage is hyper-dense.. Taking the shape of basal ganglia >> HTN

Intracranial Hematomas Head injury

- Intra parenchymal hematoma
- Epidural hematoma
- Subdural hematoma
- Subarachnoid hemorrhage

* Most commonly affected artery is middle menengial


Skin of scalp
Periosteum
Bone of skull
Periosteal
Meningeal
Dura mater
Arachnoid mater
Pia mater
Arachnoid villus
Blood vessel
Falx cerebri (in longitudinal fissure only)
Superior sagittal sinus
Subdural space
Subarachnoid space
Superior sagittal sinus
Falx cerebri
Occipital lobe
Tentorium cerebelli
Falx cerebelli
Cerebellum
Arachnoid mater over medulla oblongata
Straight sinus
Crista galli of the ethmoid bone
Pituitary gland
Parietal bone
Scalp
Dura mater
Transverse sinus
Temporal bone


Scalp
Skull :- Periostium
Periosteal dura mater
Meningeal dura mater
Arachnoid mater
Subarachnoid space
Pia mater
Cerebral cortex

* Blood appears Hyperdense in acute phase

2- Subdural hemorrhage

* Subdural space crosses the sutures → Hemorrhage is on wider space
* Usually venous
* Most of cases are caused by trauma (epidural اكثر بدرجة أقل من ال)
* Appears as a cressent shape semilunar, Hyperdense in acute phase
* Subdural Hemorrhage → Acute → Subacute → Chronic as it's wide space & venous
* Can be found accidently
* ممكن يأخذ وقت طويل حتى يعطي symptomes.

Epidural Hematoma

- Collection of blood between the inner table of the skull and the dura
- Most often occurs as a result of an arterial injury, usually middle meningeal artery or one of its branches, and therefore are usually temporo-parietal in location.
- The typical CT appearances of epidural hematoma is biconvex or lenticular, high density lesion.

Dura is attached to sutures >> epidural haematoma is limited in that space >> appears biconvex
It's usually caused by fractures/trauma
Blood is arterial
Most commonly temporo-parietal

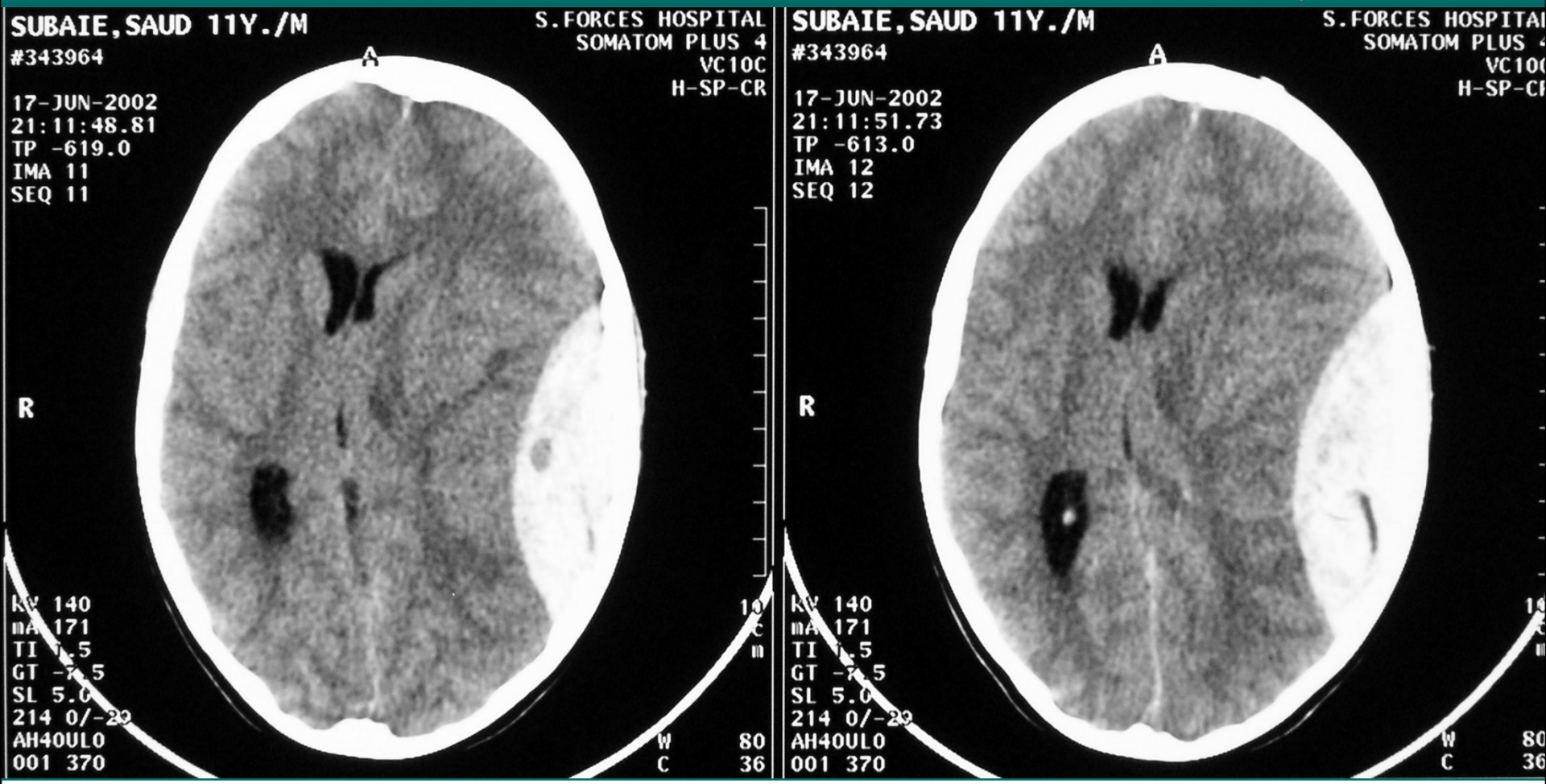
*In Epidural hemorrhage, even if patient is oriented & the hemorrhage is minimal, he should be reffered to a hospital with neurosurgen and monitored for 24 hours, because he may deteriorate any time within seconds.

Haemorrhage is typically homogenous دوااك
Sometimes it's not >> SWIRL SIGN
Since the space is limited, and blood is arterial in origin (there's a high blood flow) >> blood swirls within this space
These swirls appear as hypo-dense areas within the hyper-dense are of haemorrhage

* Hypodensity within the hyperdensity

Epidural haemorrhage – arterial blood – high blood flow – actively bleeding lesions >> this may eventually cause herniation

Shouldn't appear to public ← patient profile الخطأ بالصورة وجود ال *



This is brain CT scan, ventricular level, young male pt.. Well defined biconcave hyperdense area in the parieto-occipital lobe of the left side causing shifting of the midline to the right side and compression of the left-side structures. It is epidural haematoma

By liquefaction → Blood returns to fluid → Hypodense
in chronic state

* كتير من ال elderly بصير عندهم subdural hematoma spontaneous ← مرات بتيجي في حالة ال subacute

With age → emissary veins become fragile
← مع ال Brain Atrophy
صارت ال space → widened
فبتنسحب ال menanges ← بصير stretch لل veins وبصيرلهم Rupture Easily

3. Subarachnoid hemorrhage

* Subarachnoid spaces 1- Between sulci
2- Basal cisterns
At the base of the skull
حول ال Brain stem

Subdural Hematoma

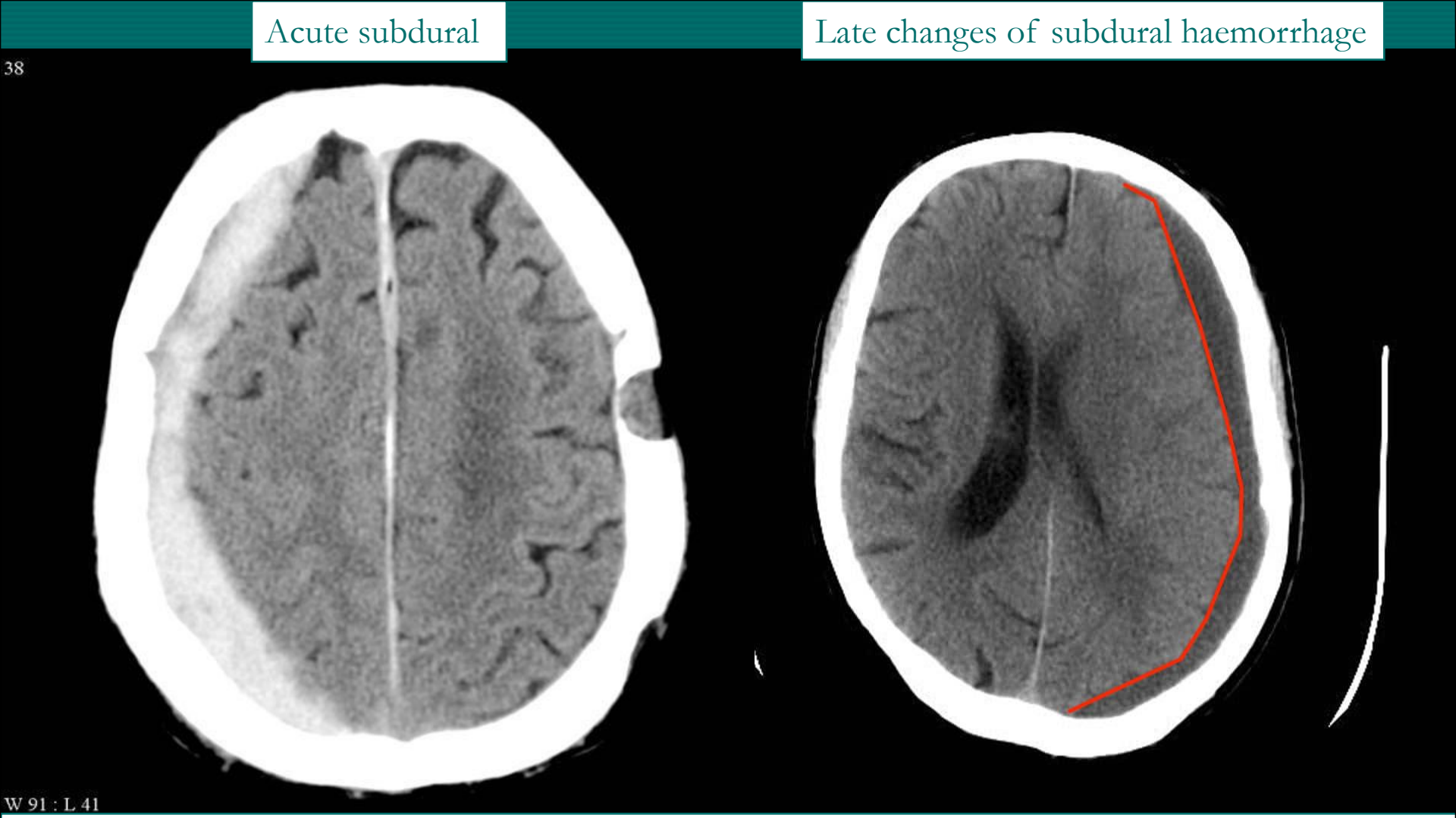
- Collection of blood between the dura and arachnoid
- Result from venous injury, usually tear of the bridging cerebral veins within the subdural space.
- The characteristic appearance of acute subdural hemaotma on CT is hyperdense crescent-shaped collection with concavo-convex configuration.

Occur in extremity of ages very old or very young
Very old: have brain atrophy and stretched veins may be spontaneous or due to minor trauma
In young, maybe a major trauma
Usually not related to fractures
Blood is venous
Not limited by the sutures >> crescent shape

in acute: hyperdense crescent shape
in chronic : hypodense due to liquefaction; all cells becomes in fluid status (bcz it's venous blood)
as patient is lying on bed so cells and fluid accumulate posteriorly >> the hematoma appears more hypo-dense anteriorly but more hyper-dense posteriorly

Acute subdural

Late changes of subdural haemorrhage

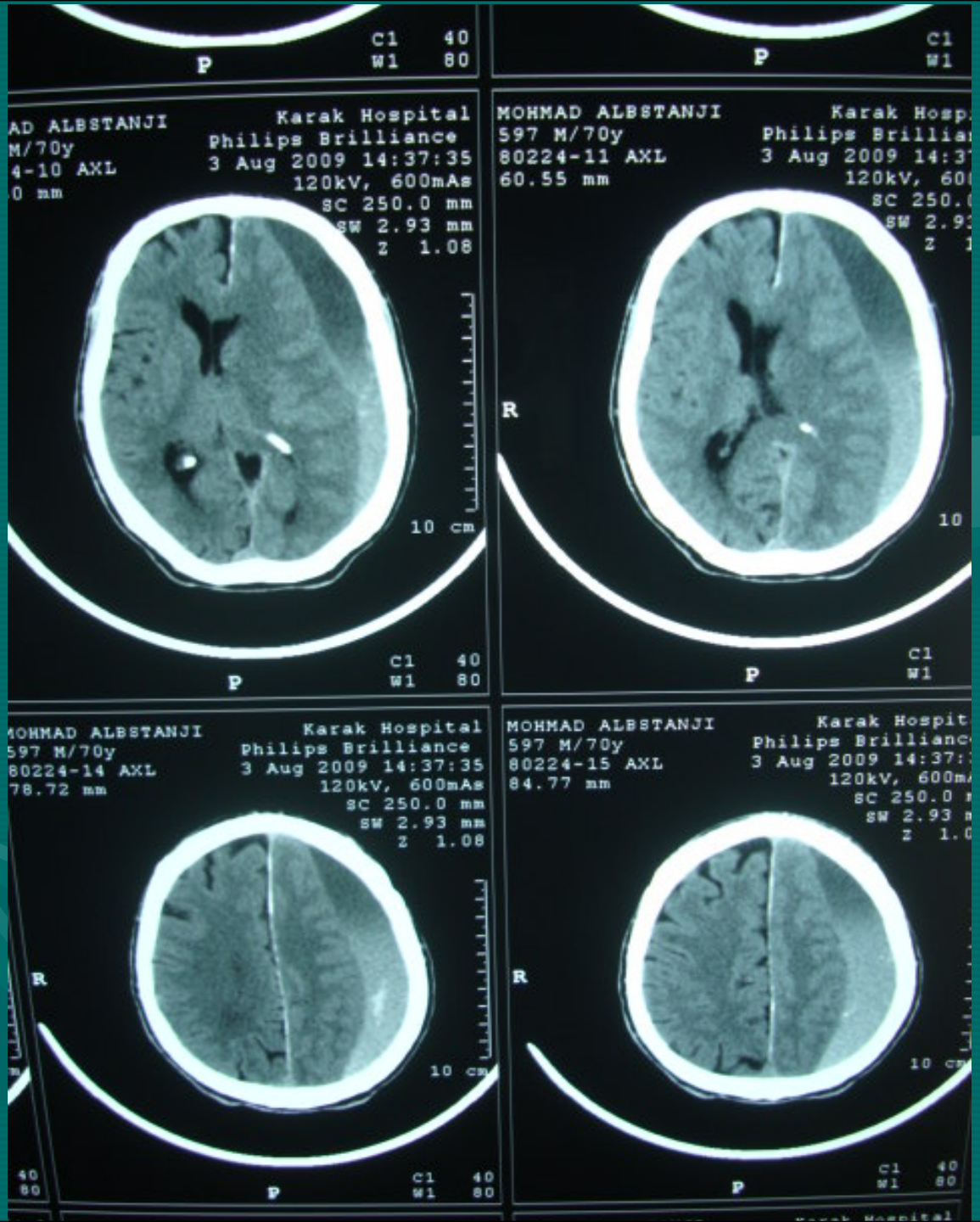


Epidural vs subdural haematoma…

Epidural must be immediately referred to tertiary centre with neurosurgery unit.. Bcz the blood is arterial (high flow) it may rapidly deteriorate.. Pt must be continuously monitored there, since at any moment a surgery may be required..

While subdural haematoma is venous, should be referred but we're not as much in a hurry.. Since it may progress rapidly but may also stop with proper medications and monitoring

Also subdural - late



Normally fluid on CT appears Hypodense → Black → * Subarachnoid spaces normally appear black

* Subarachnoid hemorrhage → * Subarachnoid spaces appear hyperdens

* So Never to add contrast as contrast appears Hyperdense & can mask the hemorrhage

* Brain responds to any trigger by edema

- Ischemic stroke appears Hypodense on CT (زيها زي الfluid)
- Contusions appear hypodense
  → But because they are generalized they appear on multiplaces on the brain → Multifocal area of edema (hypodensity)

* يعني مثلاً إذا صار فيه Direct impaction على الfrontal ممكن نلاقي على الـfrontal area الـContusion
ومكن نلاقيها بالجهة المقابلة ← الoccipital

* مرات within this contusion ممكن يصير الـCapillaries أو الـarterioles rupture
ويصير فيها Hemorrhage ← within the hypodensity

* Infarction or contusion ??
- Multiplacity → Contusion
- History → Truma or dis-arthea ---etc

Subarachnoid Hemorrhage

- Hemorrhage into the CSF spaces, and frequently present in the acutely injured patient.
- SAH appear as hyperdensities filling the CSF spaces (basal cisterns, cerebral sulci, sylvian fissures and interhemispheric fissure).
- Subarachnoid hemorrhages are most often the consequence of penetrating injury, rupture aneurysm and systemic hypertension.

Most common cause is traumatic (penetrating injury)
But most common non-traumatic is rupture aneurysm

→ Trauma is more common than Aneurysm.

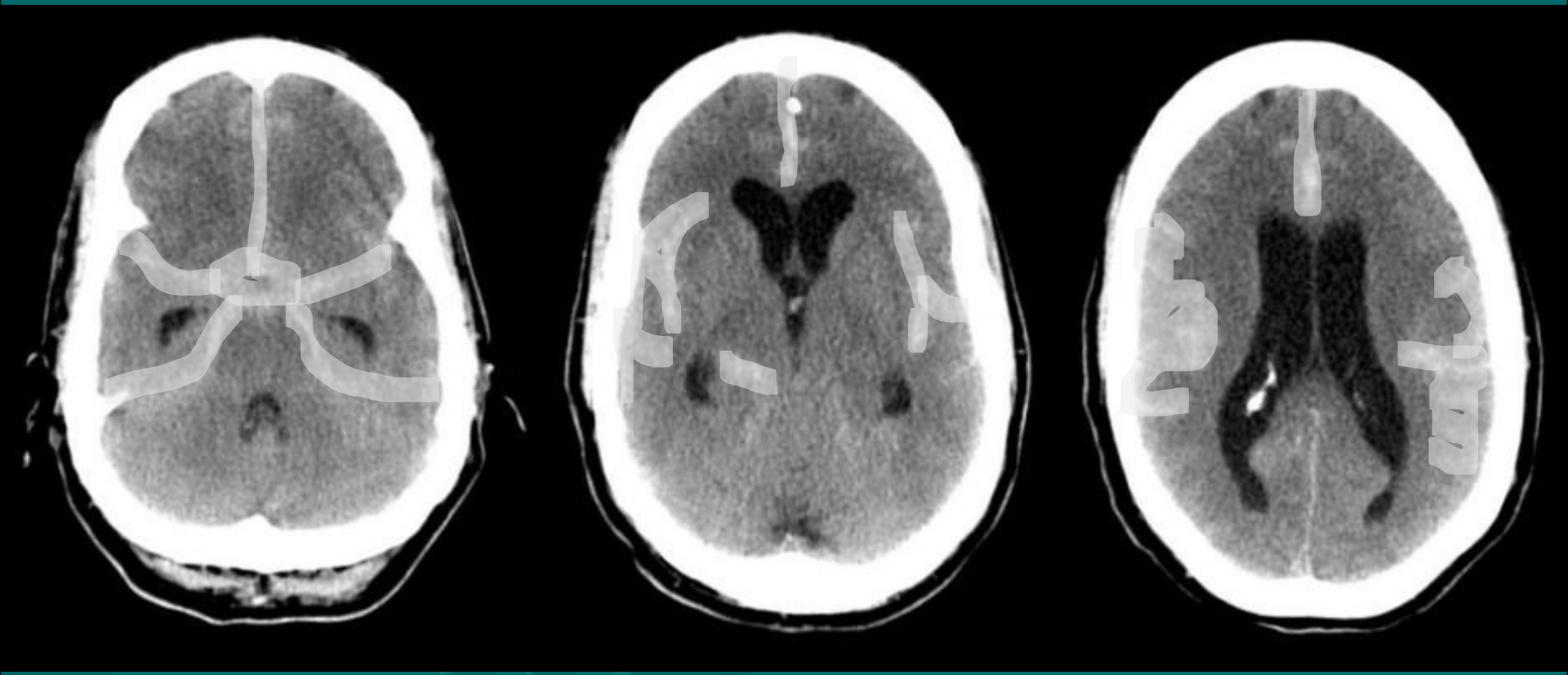
On CT, CSF spaces normally appear hypo-dense.. In SAH, you find areas of hyper-density

Best seen using MRI T2 star sequence (hypo-intense).
But it's quite expensive and not always available..

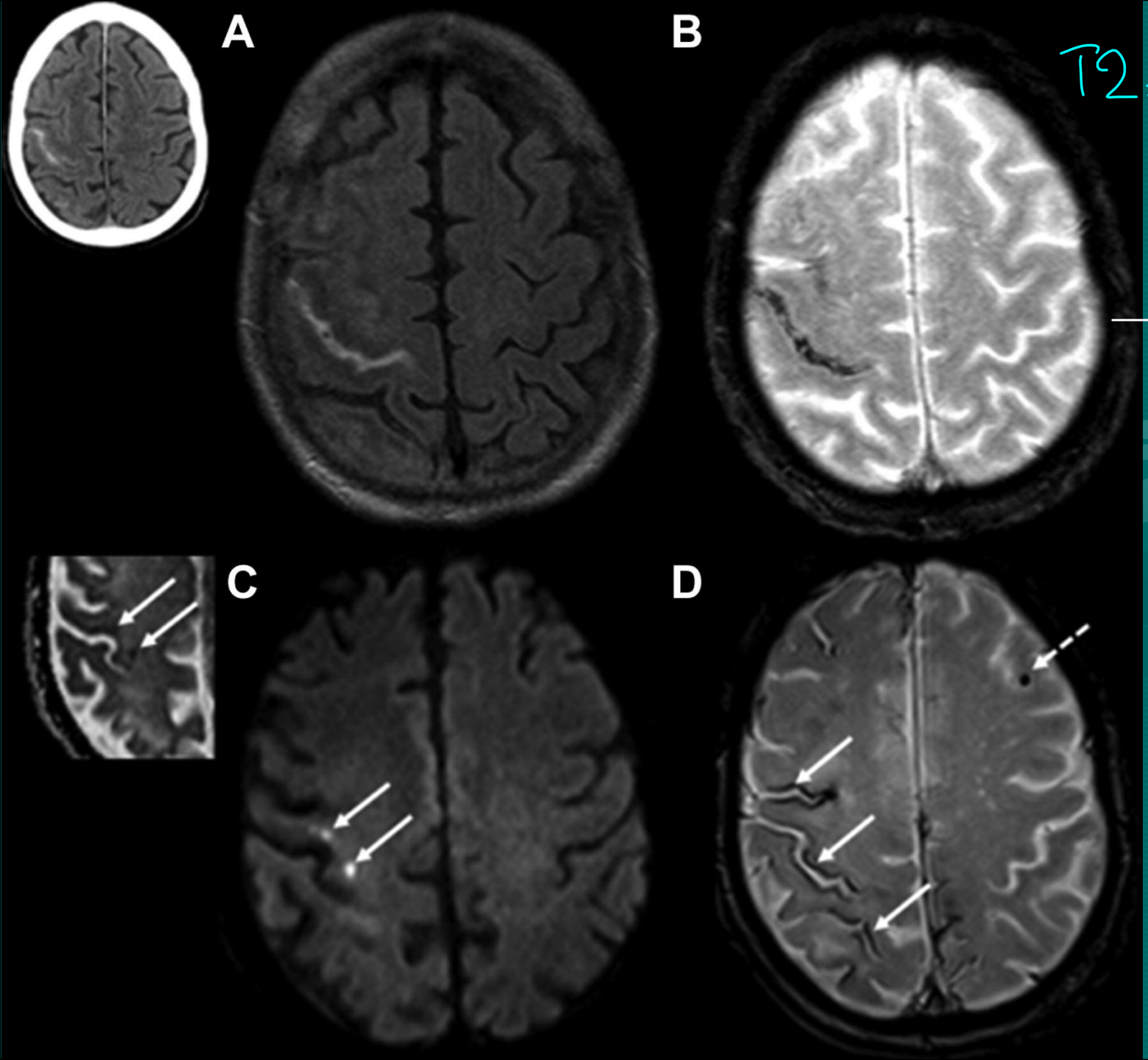
*In MRI, the most sensitive sequance to detect hemorrhage is called gradiant echo sequance

Signs of SAH: vomiting ,meningeal(sings like neck stiffness) sever sudden headache → The worst headache he had ever

Muti-axial CT, multiple areas of hyper-density filling the sulci



http://casemed.case.edu/clerkships/neurology/Web%20Neurorad/SubarachnoidHemorrhage3.htm



T2*

→ Sulci should be black (CSF زي ال)

But hear it appear filled with hyperclense material (Blood)

MRI

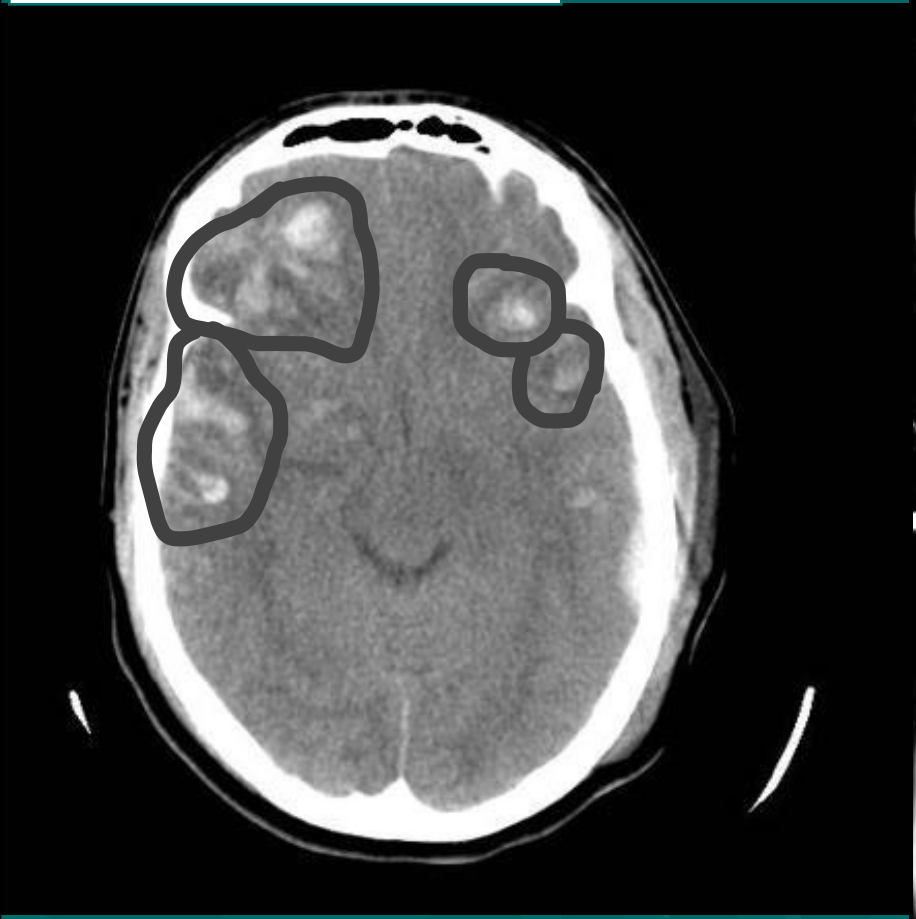
Cerebral Contusion

- Bruising or crushing of brain tissue.
- Two types of cerebral contusion:
  * nonhemorrhatic (necrotic)
  * Hemorrhagic
- The hemorrhagic areas may not be evident in the very acute stage or in the first 24 hours.

Usually due to acceleration-deceleration like car accidents >> shearing of axons >> brain respons to triggers by oedema >> multifocal areas of hypo-density on CT >> within these areas there may be haemorrhage (haemorrhagic contusions) >> areas of hyper-density within hypo-density

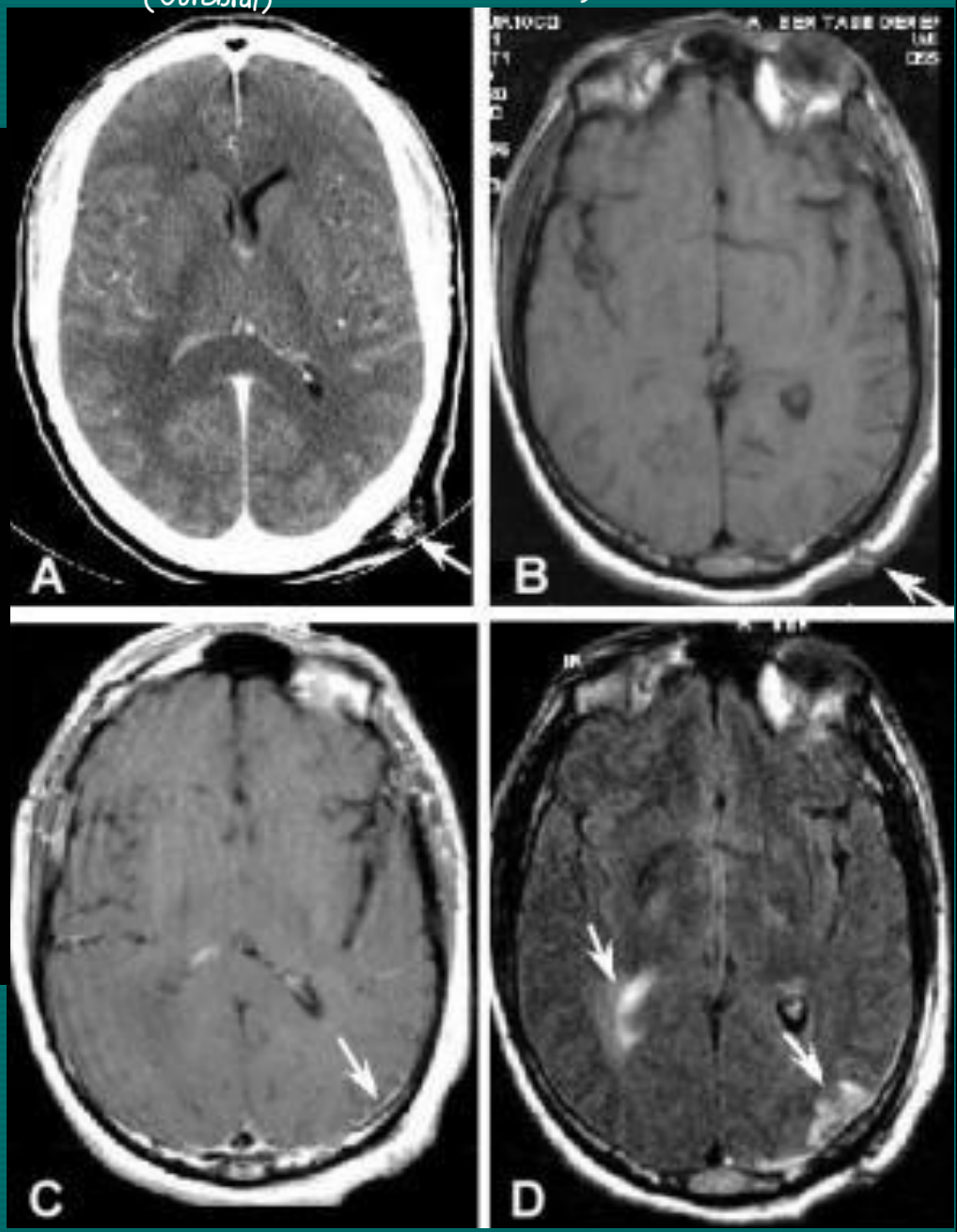
Multifocal area of hypodensity

Hyper- within hypo-density



Hemorrhagic versus non-hemorrhagic

Brain (cerebral) contusions caused by → Direct impaction
→ Acceleration – deceleration



How MS Appears on MRI ??

* It appears as an oval shape white matter lesions Hyperintense on T_2 & flair sequances & mostly affecting periventricular area.

Characteristic features → 90° degree with the lateral ventricle on sagital view

In T_2 → CSF in ventricles appear hyper intense
↳ MS lesions appear hyper intense } → lesions can be easily missed لأنهم واللي جنبهم نفس اللون

In flair → CSF → Hypointense (We canceled the signal of fluids)

The most common WM dz

Multiple sclerosis (MS)

Auto immune disease

- **MS is a white matter disease**, affects areas of the brain and spinal cord, destroying the fatty layer (the myelin sheath) which wraps around nerve fibers, resulting in areas of demyelination.
- Most common in young people and about two thirds of patients are female.
- The demyelinating lesions (plaques) present with a characteristic relapsing and remitting course.

CT may not show lesions.. we should also do MRI for spinal cord.
-Hyper-intensty lesions in the deep white matter/ subcortical white matter mostly periventricular and perpendicular to the lateral ventricles
-Flair is the best sequence.. used with contrast to detect active lesions this is important in follow up during treatment

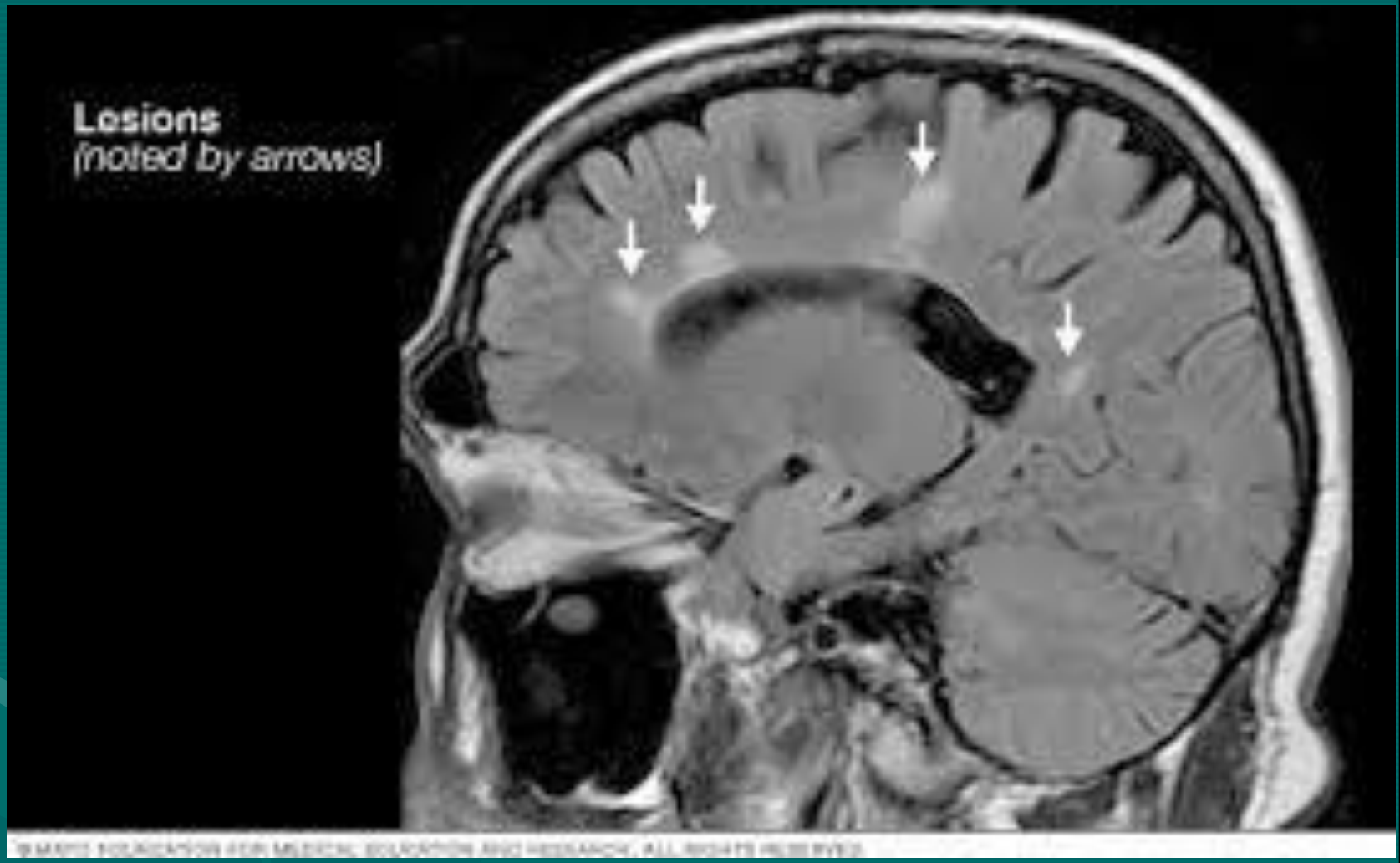
*Modality of choice for MS is MRI

Multiple sclerosis / 2

- **MRI is the investigation of choice.**
- The demyelinating plaques appear as focal discrete areas of abnormal high signal intensity on T2-weighted images.
- The common location of plaques are in the periventricular region, corpus callosum, and to a lesser extent in the brain stem, cerebellum, optic nerves and in the spinal cord.
- Contrast enhancement of the plaques indicate active disease.

On T2, both CSF and the lesions are hyper-intense >> we may miss the lesion
That's why FLAIR is the sequence of choice for MS, as it supresses the CSF so we can see the lesions more clearly

* Perpindicular to the lateral ventricle



1* Most important to determine if it's intra axial or extra axial

Brain Tumors

Metastasis can be intra- or extra- axial

Primary brain tumors can be classified as:

Intra-axial tumors: within the cerebral tissue

arising in brain parenchyma. : Glial cells , Astrocytes , Astrocytones , Oligodendrocytes , etc .

Extra-axial tumors: Outside the cerebral tissue

arise from cells outside the brain, such as the meninges and cranial nerves. , Blood vessels , Bones

Most common primary brain tumours in adults : Supratentorial tumours
Most common primary brain tumours in children : infratentorial tumours
Tumours can be seen without contrast but we always use it to intensify the picture(low grade tumours there is no enhancement but grade 4 there is enhancement)

2* Then determine if it's supratentorial or infratentorial

3* Determine the age of the patient

Brain tumors / 2

GLIOMAS:

More than 50% of primary intracranial tumors are gliomas, and constitute a heterogenous group of tumors including:

- Astrocytomas.
- Ependymomas.
- Oligodendrogliomas.

* طبيب الأشعة التشخيصية بيعطي Narrow differentials أو بيجبل diagnosis من خلال الصورة ، مش وظيفته إنه يصورها بجدين بيأخذ الـ Histopathologist عينة و بيشخص على أساسها كمان .

Astrocytomas

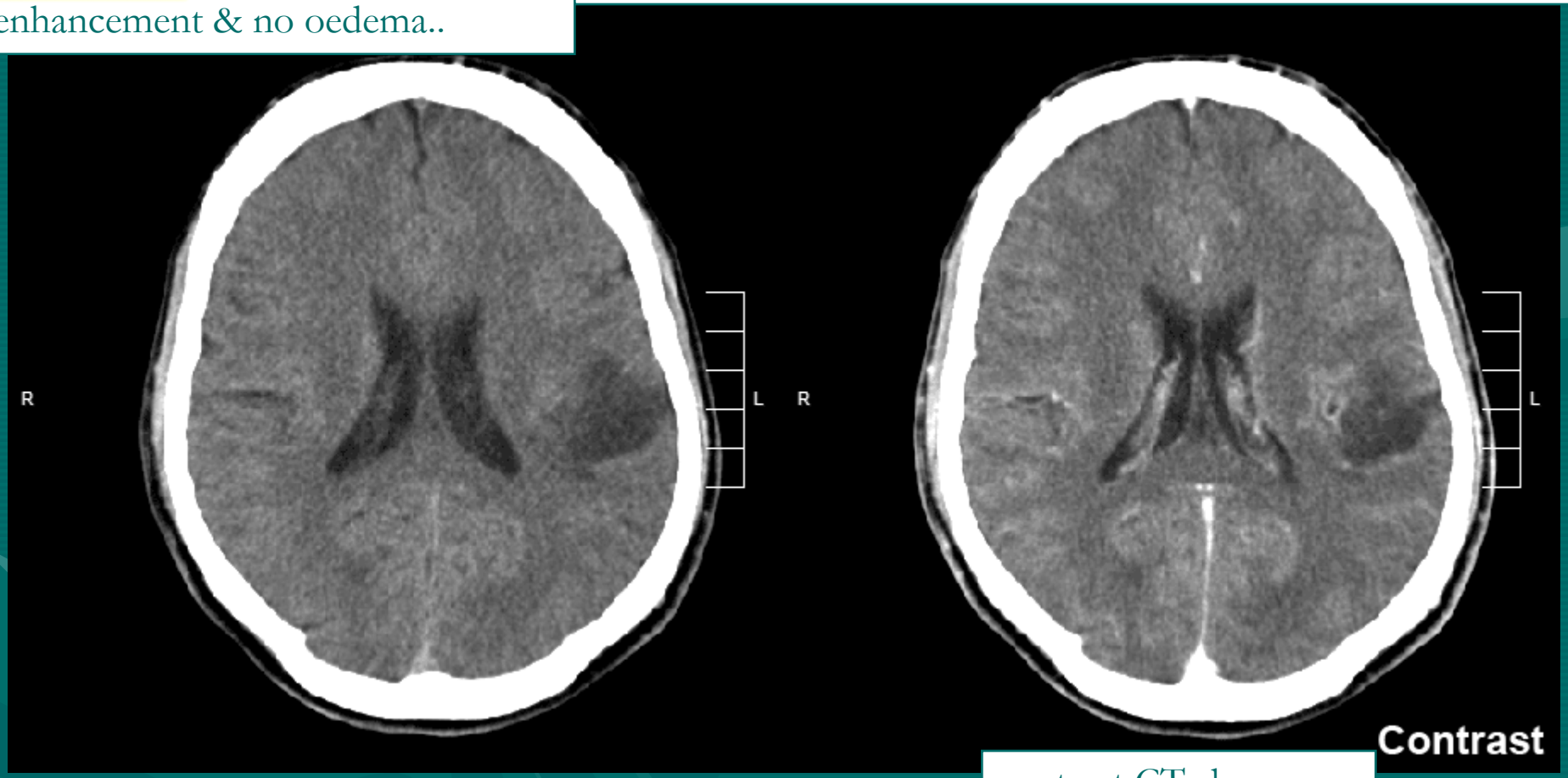
- Arise from astrocytes
- Graded into four grades depending on the severity and prognosis (grade I favourable prognosis and grade IV worst prognosis)
- The low grade astrocytomas are most commonly in young adults.
- The high grade astrocytomas (grade 1V) are called glioblastoma multiforme.

MRI is the best for brain tumours but we can use CT scan. Low grade gliomas on CT appear as areas of hypodensity.. With no contrast enhancement & no oedema..

Areas of hypodensity could be infarction or tumour – diagnosis depends on history

Acute onset of weakness/paraesthesia >> probably infarction

History of headache for a long time>> tumour

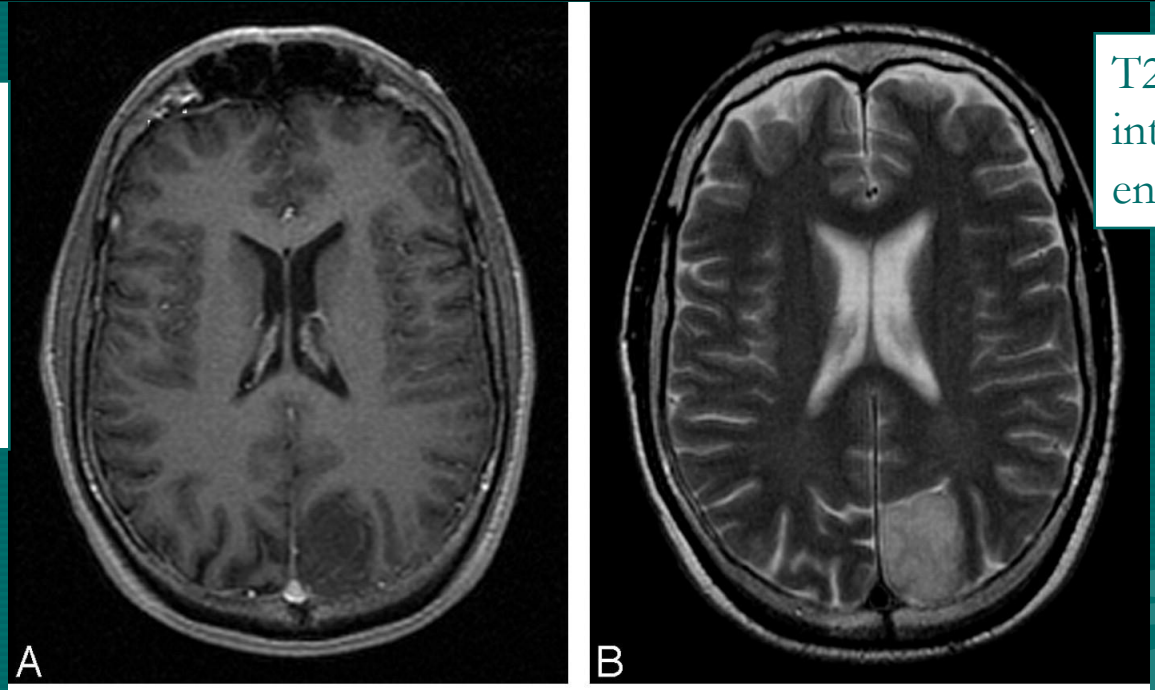


-the superior sagittal sinus with contrast is enhanced so there is no thrombosis if its not enhanced it will give empty delta sign

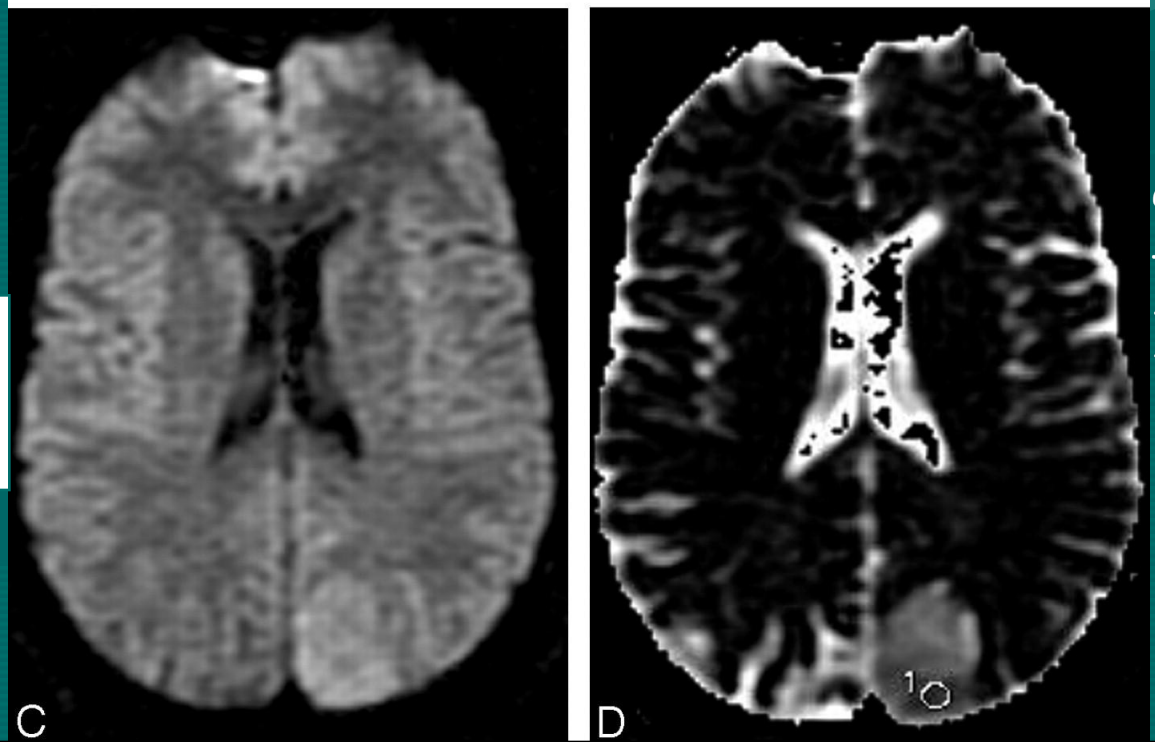
-NEXT STEP is MRI

contrast CT shows low grade tumor- no shift, no enhancement, not haemorrhage, lesion is well defined

T1.. Hypo-intense.. No contrast enhancement.. Well-defined, no oedema >> low-grade glioma



T2>> hyper-intense, no enhancement

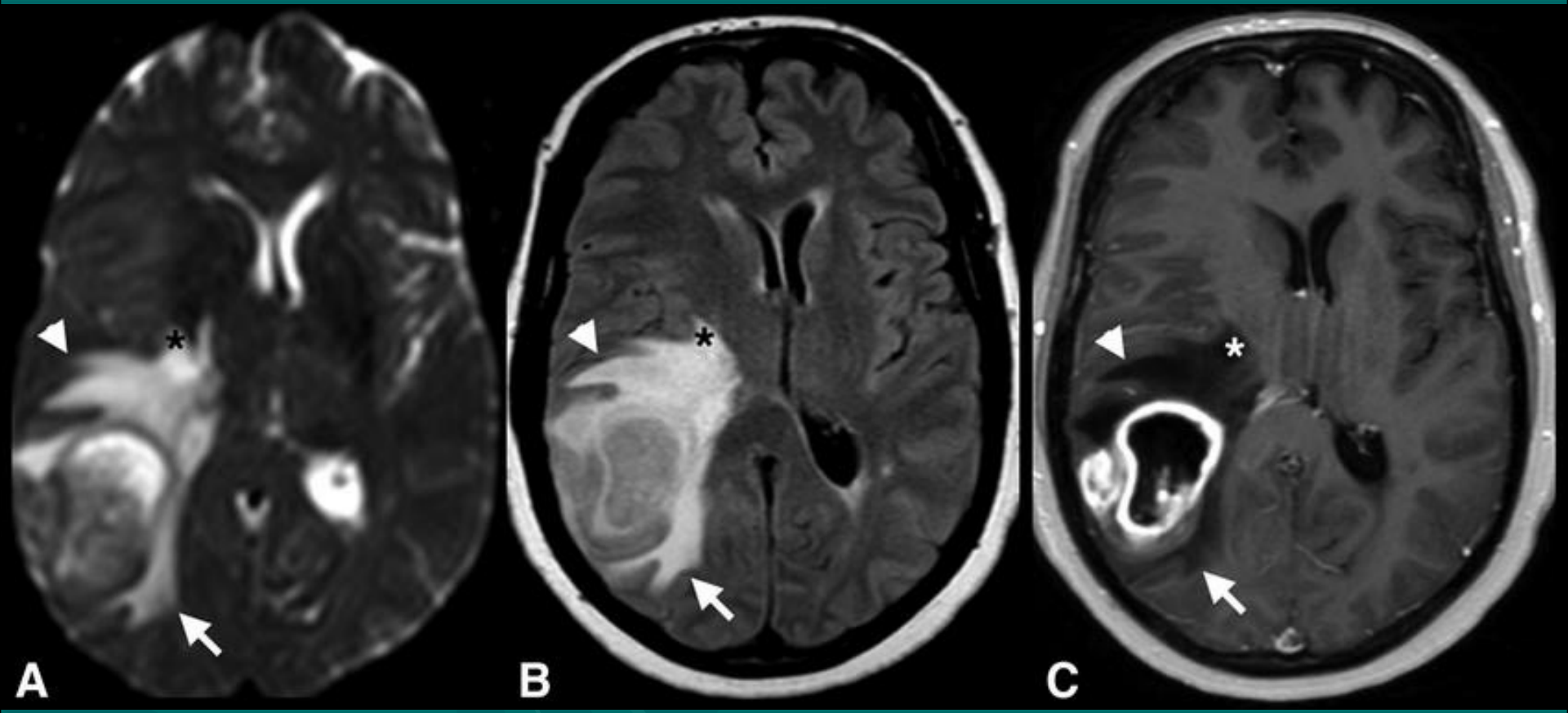


FLAIR>> hyper-intense, no enhancement

Smooth, non-aggressive appearance:
- no hemorrhage
- no edema
- No enhancement
- No calcifications

* Benign looking

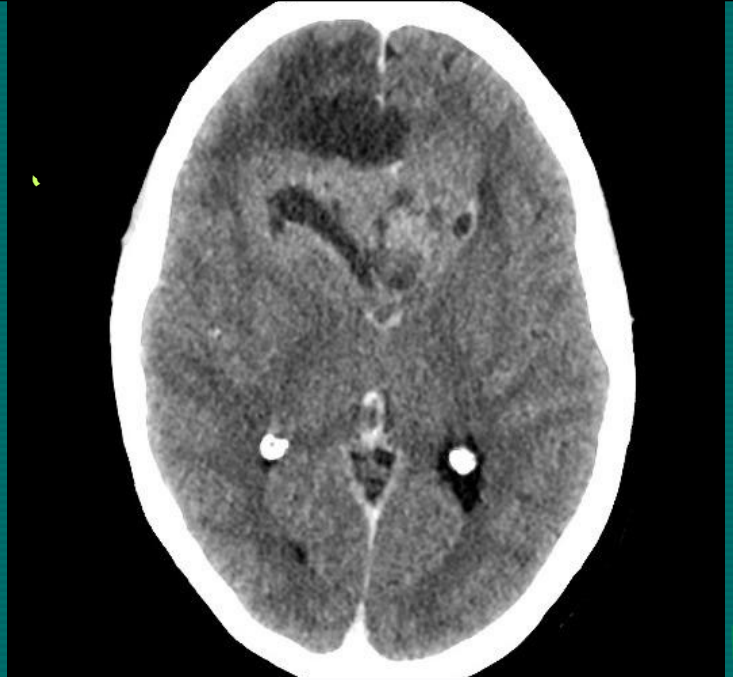
GBM Glioblastoma Multiforme



High-grade glioma>> Contrast-enhancement, with oedema, may have cystic or necrotic changes + pts are usually elderly

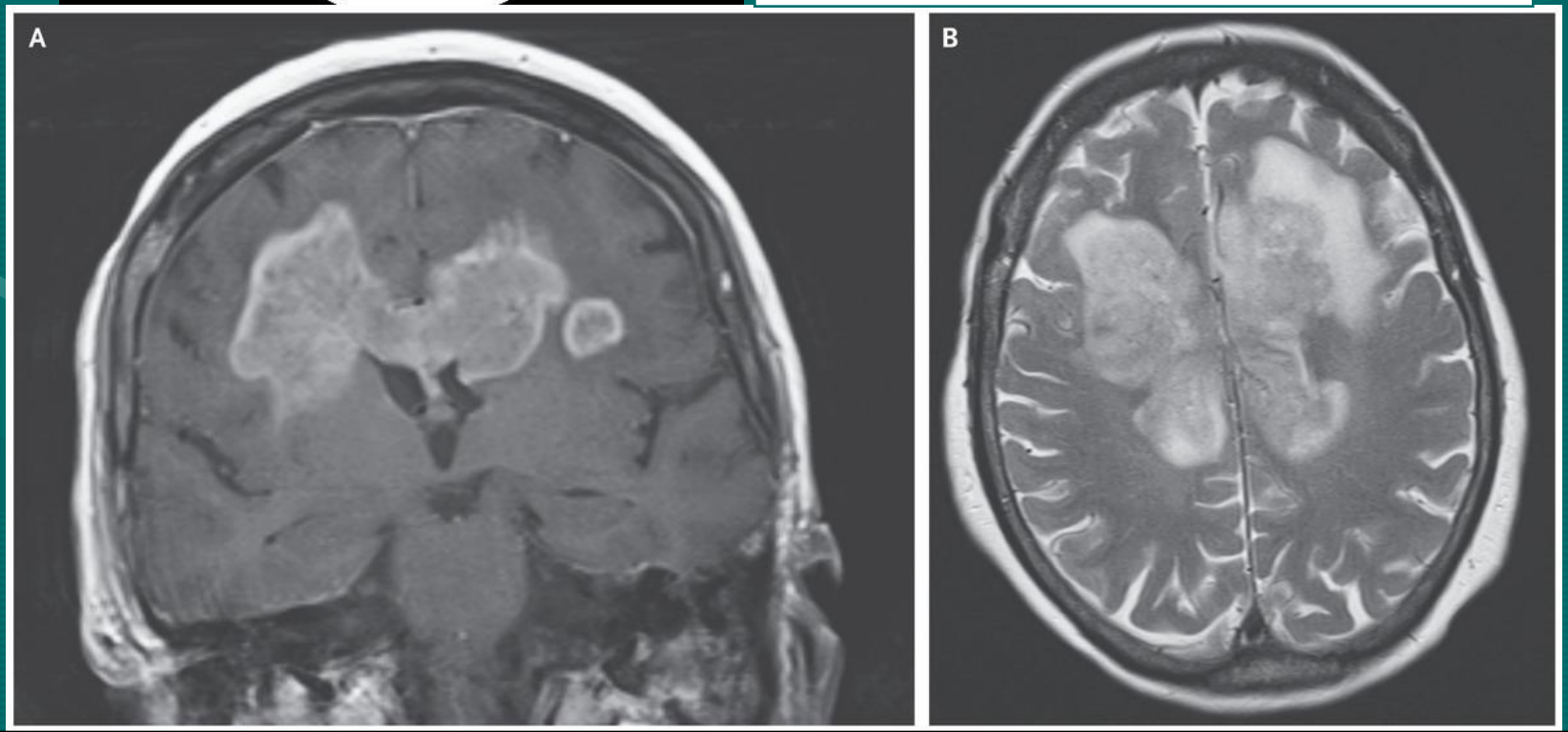
Aggressive :-
- Edema
- Enhansement
- Cavitation
- Hemorrhage

* Agressively appearace



High-grade glioma affecting corpus callosum

Few lesions affect the corpus callosum..
When you see a lesion there, it could be lymphoma, GBM, MS
MS: hyper-intense lesions, multiple
GBM: heterogenous enhancement, diffuse enlargement, >> butterfly glioma



Corpus callusum is a unique structure, white matter

* Diseases that affecting Corpus callusum are few
  - → Glioblastoma Diforme
  - → MS
  - → lymphoma

* Envolvement of Corpus callusum is one of the differentiating features between MS & other white matter diseases.
  - → Anal glioblastoma & lymphoma

Infratentorial, Cerebellar tumors, Posterior fossa tumors

*بفرقوا بين الـ adults والـ children

In adults:

- The most common cerebellar lesion is a metastasis. Even if solitary metastatic lesion
- The second most common tumor is a hemangioblastoma.

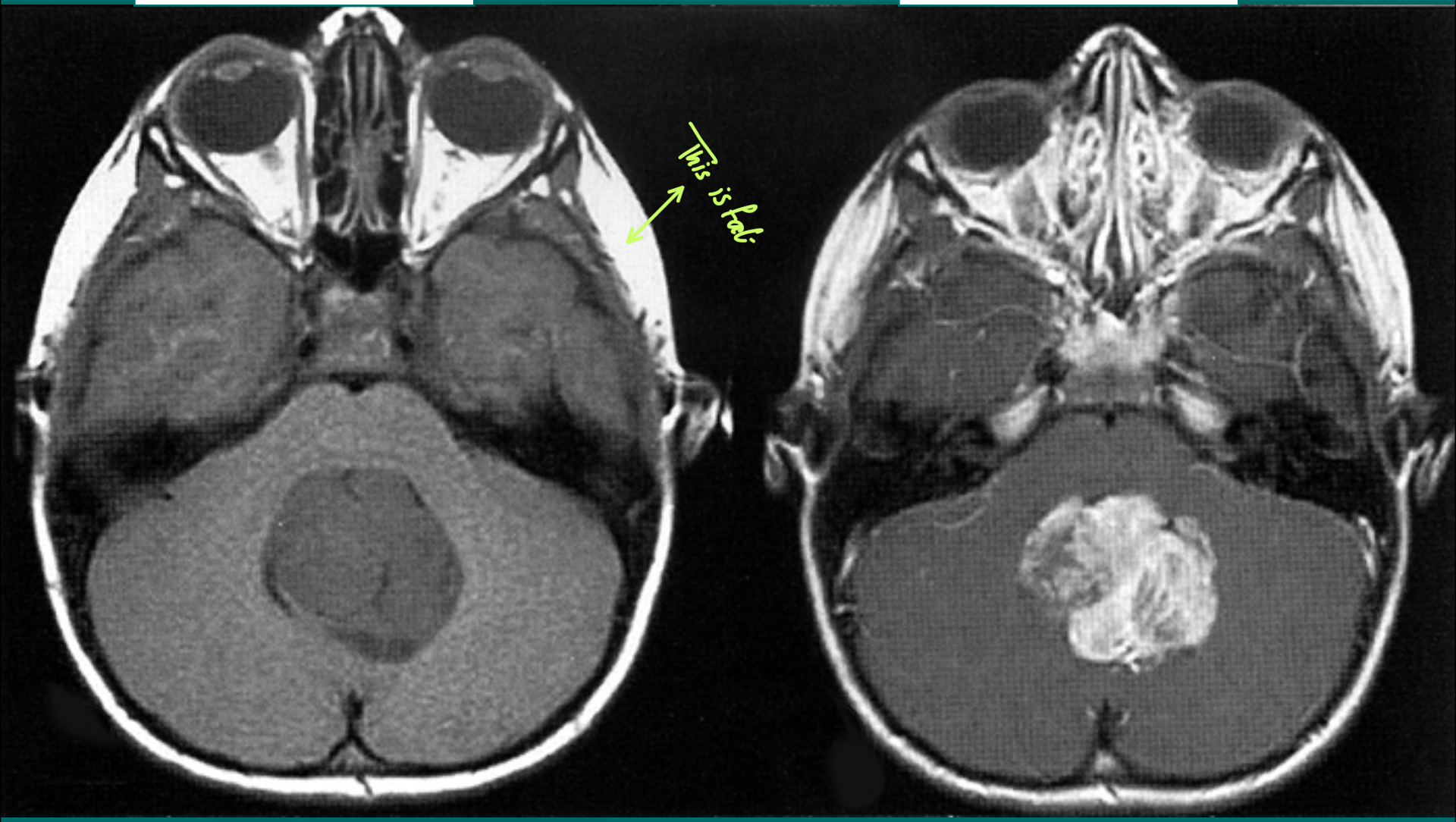
In children: These differentials of pediatrics age group (لازم تحفظهم)

- Medulloblastoma: is the most common malignant brain tumor of childhood.
- Astrocytoma.
- Ependymoma.
- Brain stem glioma.
- Atypical teratoid rhabdoid tumour (ATRT)

Mass occupying the 4th ventricle

T1- pre-contrast

T1- post-contrast



If this pt is young >> medulloblastoma
If pt is adult >> metastasis

What are the common extra-axial tumors ?

- Meningiomas
- Neuromas
- Metastasis
- Pituitary tumors

Extra-axial tumours could arise from meninges, BVs, skull, pituitary, nerve sheath neuromas (most commonly schwannomas) or metastasis

Meningiomas

The most common Extraaxial brain tumor

- Represent 15-20% of primary brain tumors.
- They are benign, well circumscribed lesions, arising from any part of the meningeal covering of the brain, most commonly in the parasagital region and sphenoid wing.
- Small punctate calcifications can be seen in 25% of tumors.
- CT or MRI show well defined lesions enhancing strongly and diffusely after intravenous contrast.

Extra-axial, well-defined, homogenously enhancing on MRI, sometimes with oedema
May see calcifications within the lesion (25%)
Typically affecting middle aged women
MRI is better than CT scan

* Appears as well defined strongly inhansing extraaxial lesion
* Usually attached to the dura (إنها لاصقة من ال Menenges)

Right frontal lobe convexity tumour (meningioma) with massive oedema causing compressing effect (we don't usually see as much oedema - this is atypical meningioma)

Modality of choice for diagnosis is MRI
we can see it on CT

* ممكن نشوف فيها Calcification

Pituitary tumors

لو خاصية إنه لازم ينزل with contrast

- The plain films show pituitary fossa enlargement or erosion.
- Adenomas smaller than 1cm are microadenomas, and larger adenomas are macroadenomas.
- MRI is superior to CT in detecting adenomas.

Micro- are usually functional, usually prolactinoma >> on imaging: well-defined area within the gland, less enhancing than the rest of the gland

Most common

Symptomes are related to the secreted hormones

less than 1 cm

Macro- involve the whole gland, extending beyond the suprasellar area, compressing the optic chiasm >> bitemporal hemianopia , usually non-functioning.. On imaging: large, homogenously enhancing pituitary, on coronal section you see 'figure of 8'

Symptomes are related to the local mass effect

Most commonly Compressed

more than 1 cm

Acoustic neuroma:

- Arise in or near the internal auditory canal and may cause widening and erosion of the canal.
- MRI is more sensitive than CT in its detection.

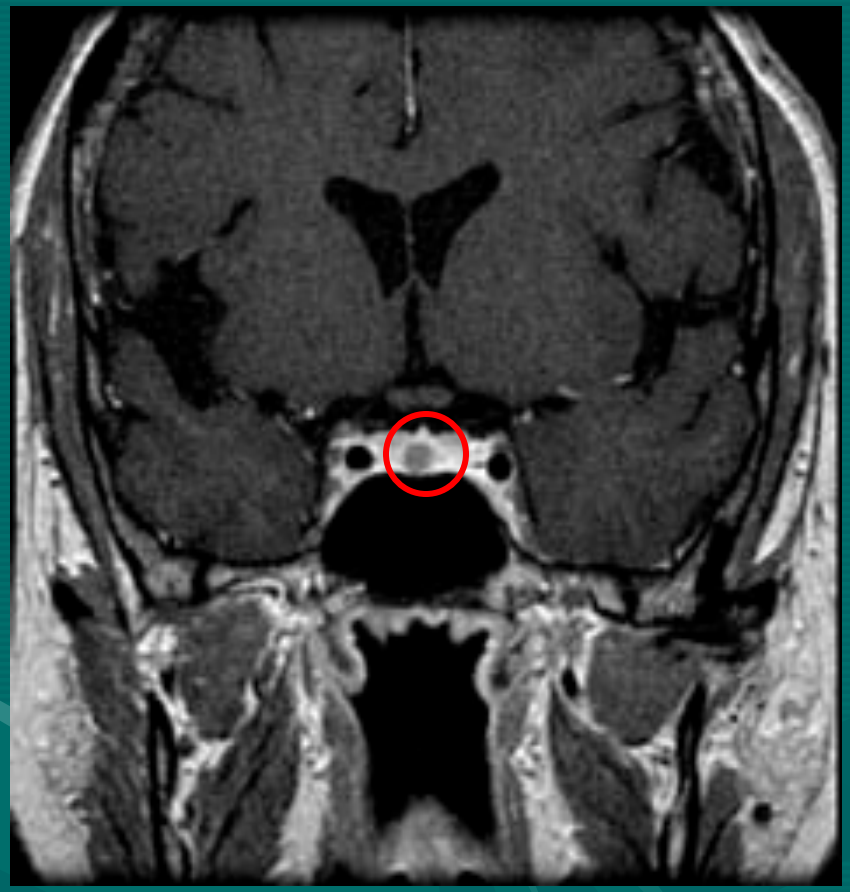
Neuromas arise from nerve sheath, they follow the tract of the nerve

Usually affects vestibulocochlear nerve >> called schwannoma, the nerve leaves the pons to inter the internal acoustic meatus through the cerebellopontine angle (CP angle) >> so, part of the tumour will be seen interring the internal acoustic meatus>> ice-cream cone shape

Well-defined, homogenously enhancing, may see cystic changes

To differentiate meningioma & schwannoma, meningioma doesn't extend to the internal acoustic meatus >> no ice-cream cone shape

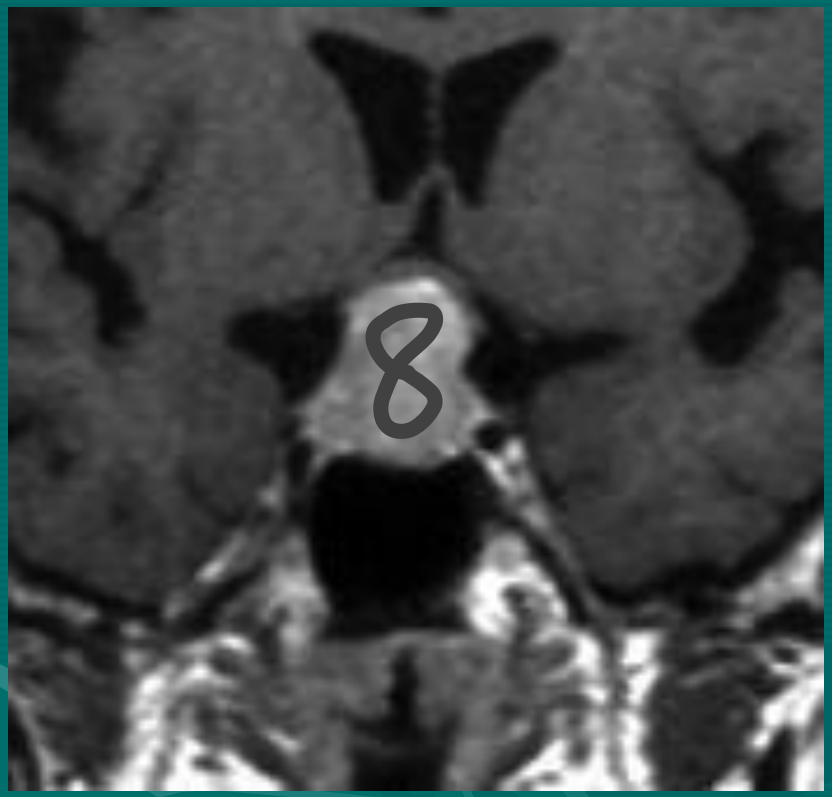
MRI T1>> Small, well-defined area within the pituitary, less enhancing than the rest of the gland >> micro-adenoma of the pituitary gland

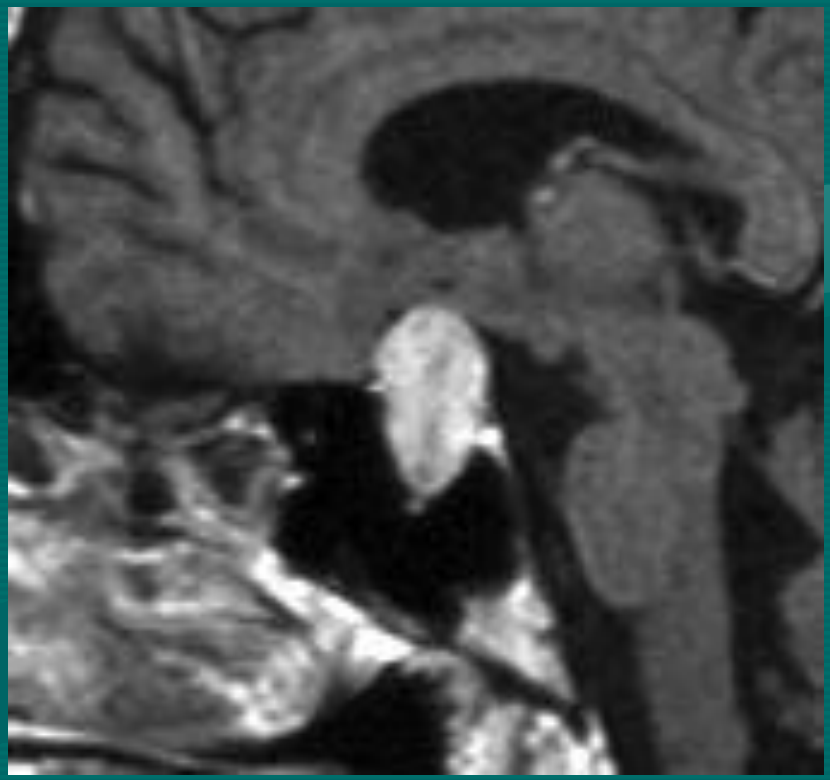


* Normal pituitary is strongly inhansing , Microadenoma (less enhansing)

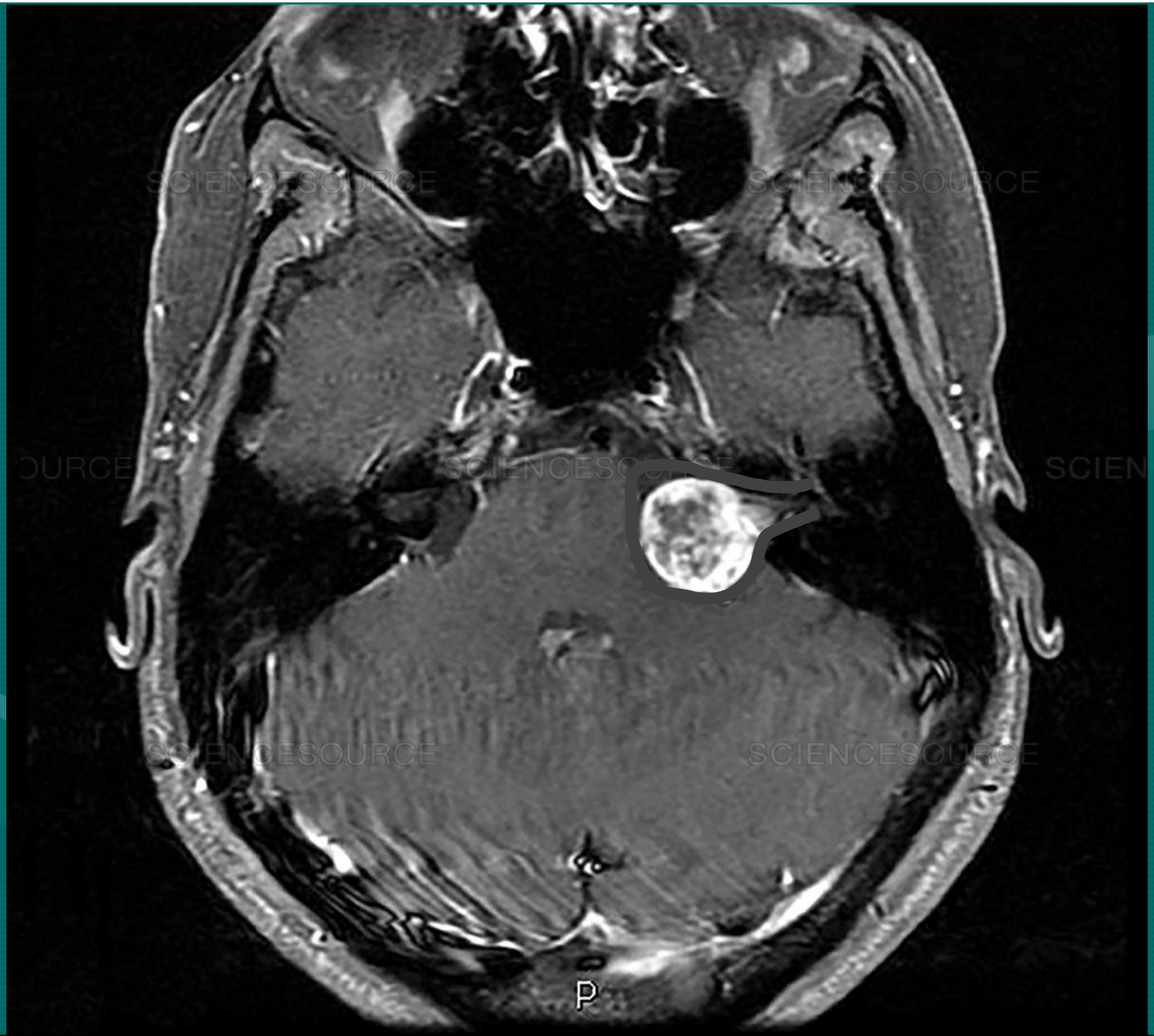
MRI T1 >> large, homogenously enhancing pituitary, 'figure of 8' on coronal section, involving the whole gland, extending beyond the suprasellar area, compressing the optic chiasm

figure of eight → Characteristic feature of microadenoma





MRI FLAIR with contrast >> Well-defined, homogenously enhancing, ice-cream cone shape on CP angle >> schwannoma



Well-defined, homogenously enhancing, no ice-cream cone shape on CP angle >> meningioma

Hemianopia :- loss of sight in half of visual field

(Shwanoma) :- Benign tumor arising from the peripheral nerve sheath within the cranium

* The most common nerve effected is vestibular (8th cranial nerve)

← بيطلع من ال Pons ويدخل في ال internal auditory canal ، يمر من خلال

ال cerebello pontile angle

* بما إنه ال shwanoma بتطلع من Peripheral nerve sheath بنشوفها بال CP Angle

← هناك فيه Menanges (أحولين ال Pons) فممكن يكون فيه منا Menangeoma

فال Other differential ال mass في ال CP Angle هي Menangeoma

* Tumor in the CP angle → Most commonly shwanoma :- Well defined, well circumscribed enhansing lesion (Extraaxial)

↳ Menangeoma ← تنسى

1- Shwanoma follows the tract of the nerve → We find componants of the mass inside the auditory canal

* بنفرق بينهم بشغلتين :

← بتبين زي ال icecream cone

2- Menangeoma doesn't enter because there are no menanges inside the canal

Most commonly intra-axial but could be extra-axial

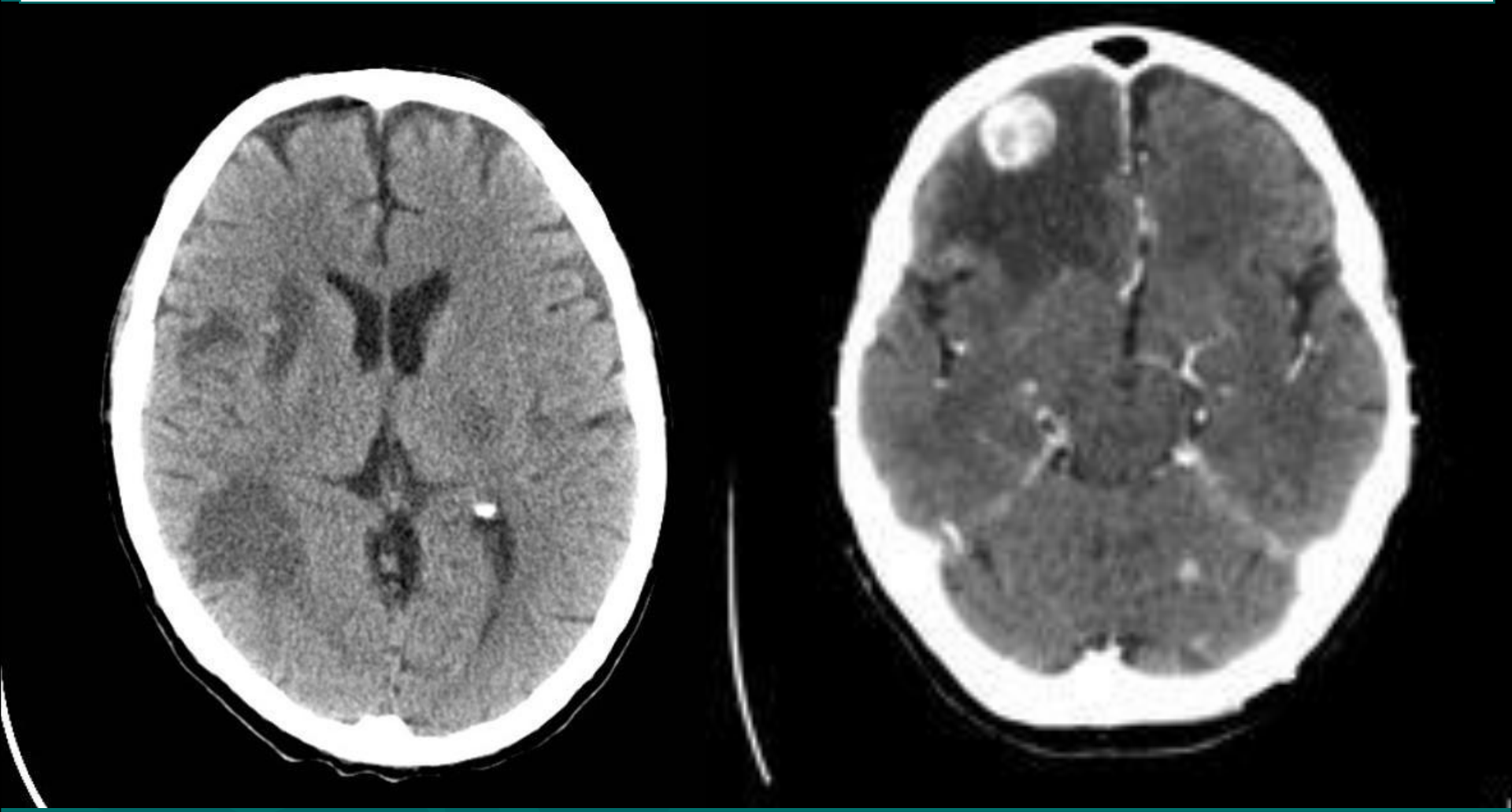
Brain metastasis

- The majority are multiple (80%)
- They can occur anywhere in the brain, but the gray-white matter junction is the commonest site.
- Metastatic lesions are usually associated with a considerable amount of surrounding edema.
- Brain metastasis are commonly from bronchial, breast and gastro-intestinal tumors.

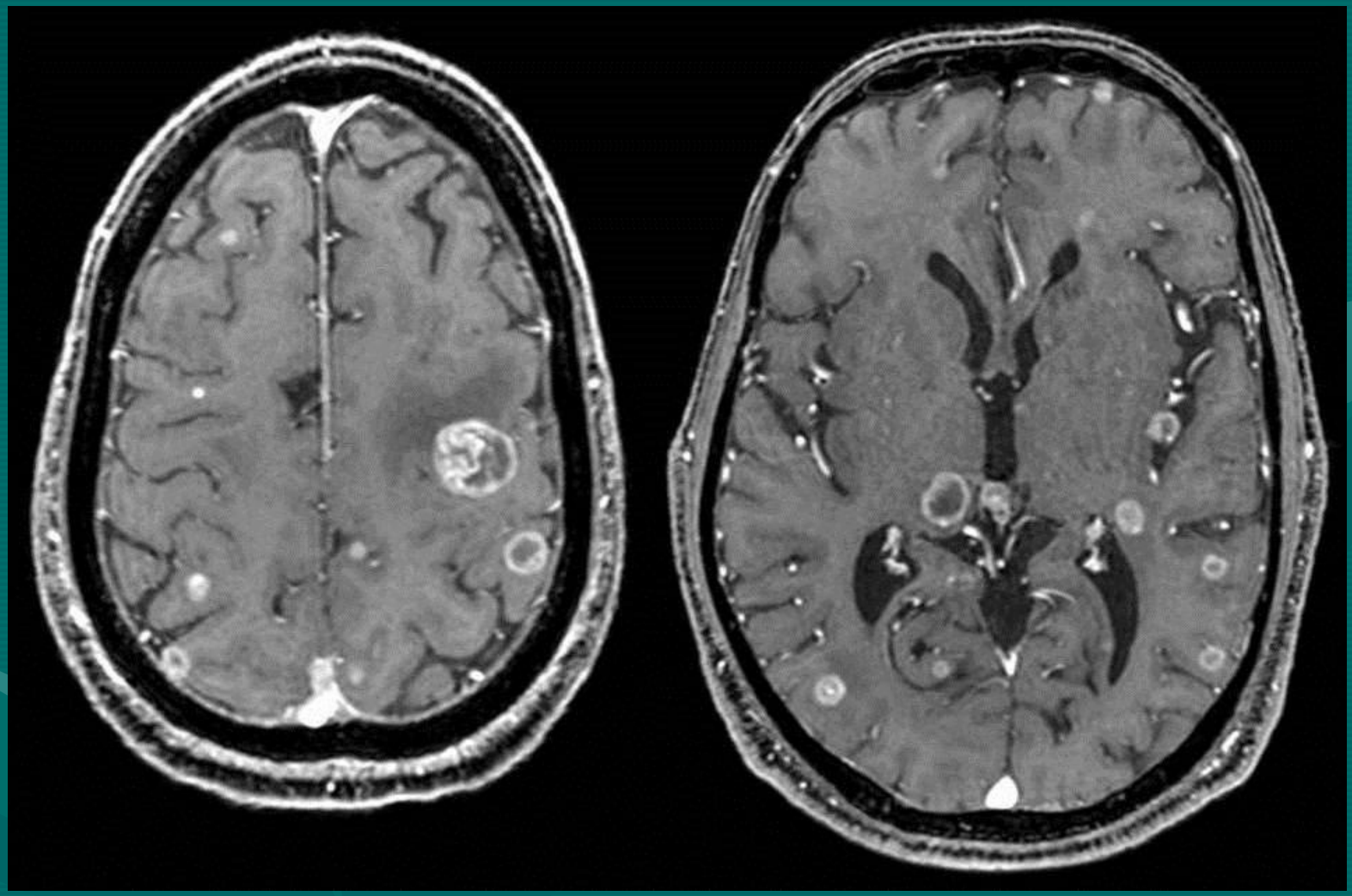
+ melanoma (melanoma produces haemorrhagic mets)

Radiologically>> multiple, well-defined, ring-enhancing lesions, usually at grey-white matter junction, oedema out-proportional to the size of the lesion

CT w/out contrast >> we may see the oedema but not the lesion itself
With contrast >> ring-enhancing….



MRI T1 >> Multiple lesions, ring-enhancing



**** Notes after the first lecture :

- When writing a report for brain tumor It's imp to know :
- If it is supra or infra "in posterior fossa"
- Age
- Cystic or solid
- Calcifications : in some tumors it is rare to find calcifications and in others it is common >>>> as in the(craniopharyngioma)In childs 90% Calcifications while in (medulloblastoma)it is impossible to find calcifications → Knowing these things about the mass helps us to determine the type of it .

**** In the barium follow through >>> the abdominal films which are taken in the first hour the pt should be in prone position because by the compression that the table makes on the pt's abdomen , the ileum would be visualized clearly .. after the first hour the films taken in supine position.

Most common tumors that metastasize to the brain:-

1- Breast
2- GI
3- Lung
4 - Melanoma

* كيف بيبينوا ال ؟؟ Metastases

1- Multible
2- Mainly on the gray - white junctions
3- Most of them show enhansement
↓
We call it ring enhansing lesions
4 - Sorrounded by edema
↳ Usually → Out proportion of the size of the lesion

Small lesion with large edema ←


Thank
You

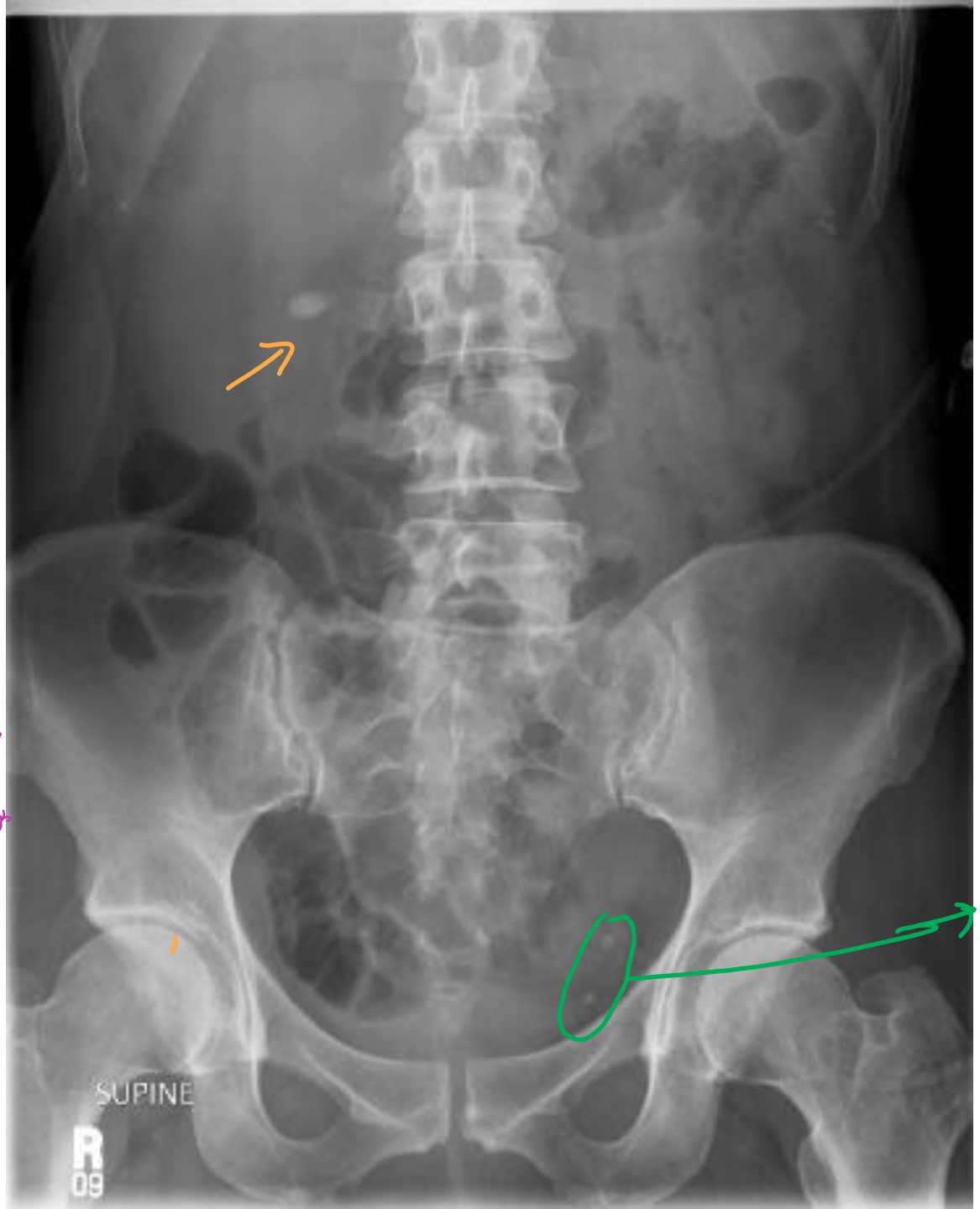
URINARY SYSTEM

URINARY TRACT INVESTIGATION

Plain film:

- Renal calculi or calcification
- Stones in the ureters
- Bladder calcifications and calculi
- Bone abnormality or metastasis

Stone in the Rt kidney's pelvis
↓
next step is US
↓
to exclude hydronephrosis



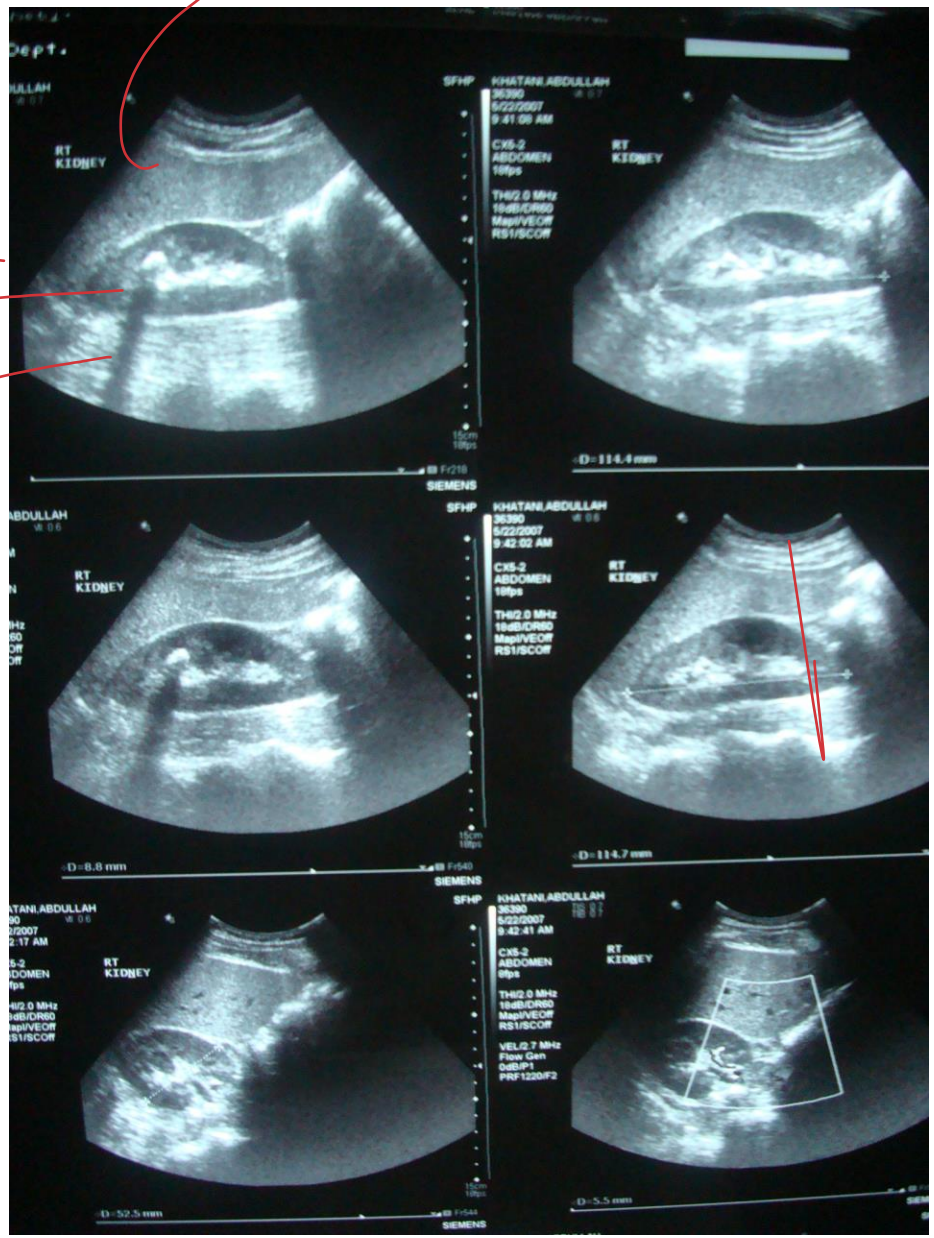
Phleboliths aresmall blood clots in a vein that harden over time due to calcification

ULTRASOUND OF THE URINARY TRACT

- Ultrasoud is one of the most valuable investigations of the urinary tract and the investigation of choice in children.

- It is very effective in evaluating renal size, masses, renal obstruction, bladder residual volume and prostatic size.

↳ The worst scenario for obstruction is hydronephrosis which means loss of cells → sooner is better (4-6 hrs)



hyperechoic shadow
→ renal stone (urine)
acoustic shadow

1) Both have blackness in the medulla
① hydronephrosis → communicating
② cyst → thin

if it is a non-obstructing stone, there will be no blackness

stone = acoustic shadow

stone

hydronephrosis with dilation of upper ureter

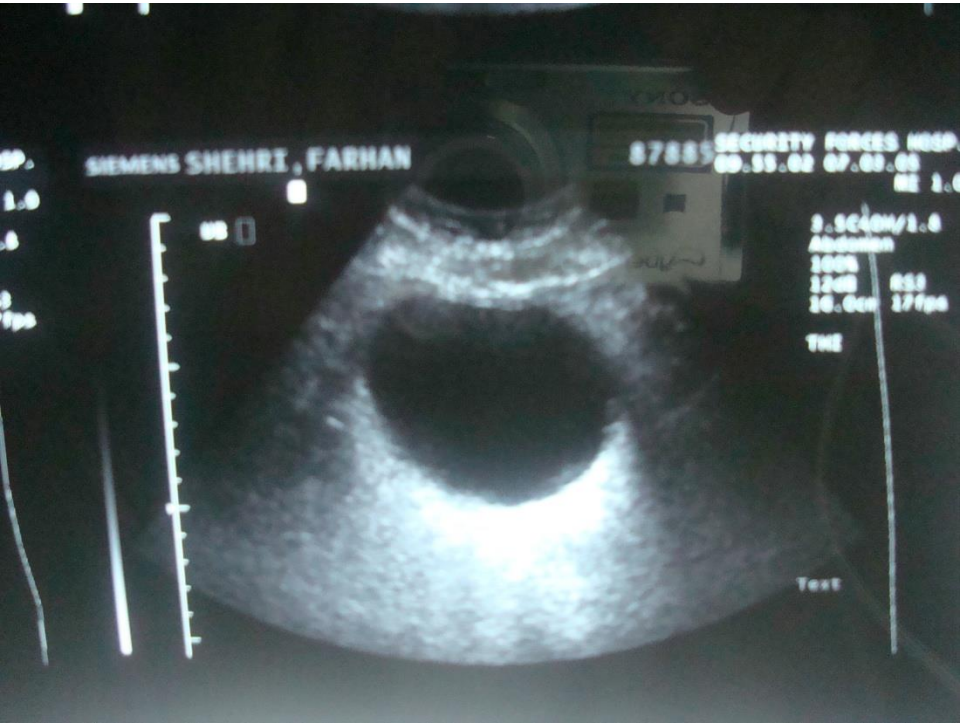
اغلب الناس 50% من اللي
عمرهم فوق ال 50 عندهم Cyst
لكنها normal

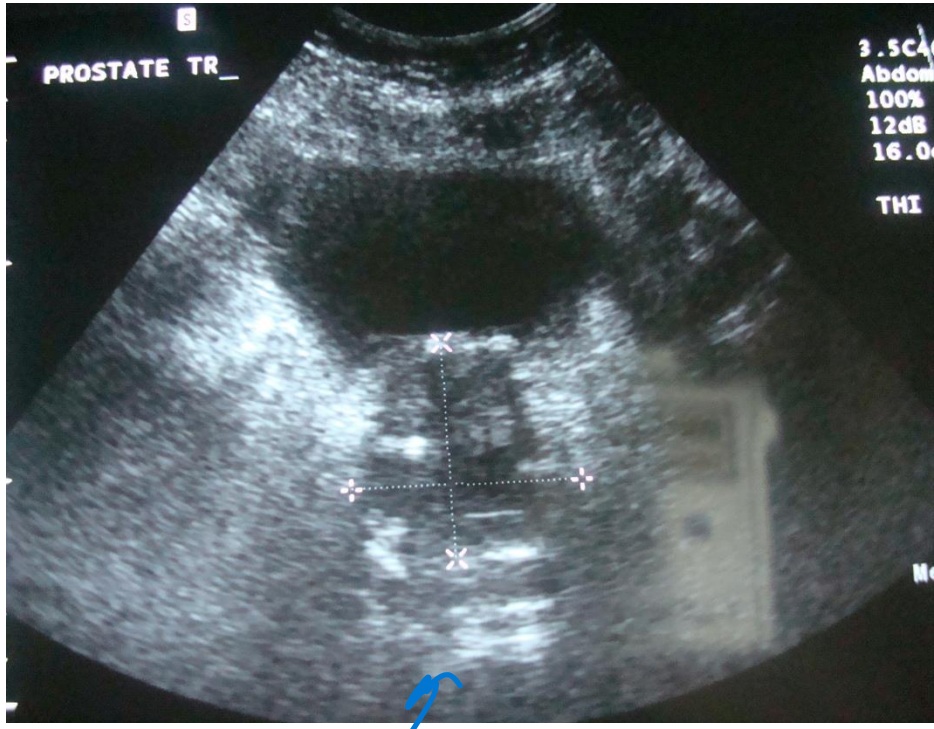
- asymptomatic
- non-develop to malignancy

- things that might be a sign of malignancy in a cyst
- not round, ill defined
- thick wall
- has soft tissue (has echoes)

cyst
- fluid
- hypoecoic

↳ Soft tissue mass as RCC





↳ bladder

- normal
- cilcular in shape

prostate

CT OF THE URINARY TRACT

CT is excellent modality for assessment of:

- Renal masses.
- Obstruction. → But it is not the initial test
- Retroperitoneal disease.
- Staging of renal and bladder neoplasms.
- Tumor invasion into the renal vein or IVC → Stage (4), life expectancy 1-3 months
- Evaluation after trauma or surgery.

* CT for kidney stone → without contrast

WHEN SHOULD MRI BE USED TO EVALUATE THI
?

- When a renal mass or abscess is suspected but itravenous contrast cannot be administered, because of either contrast allergy or abnormal renal function, in this case MRI can be performed.
- Gadolinium, the contrast agent for MRI, can be safely administered in such circumstances. (broader line cases)
- In the last few years, some studies reported that gadolinum might cause nephrogenic systemic fibrosis in patients with renal failure.
  ↳ renal failure cases, dialysis

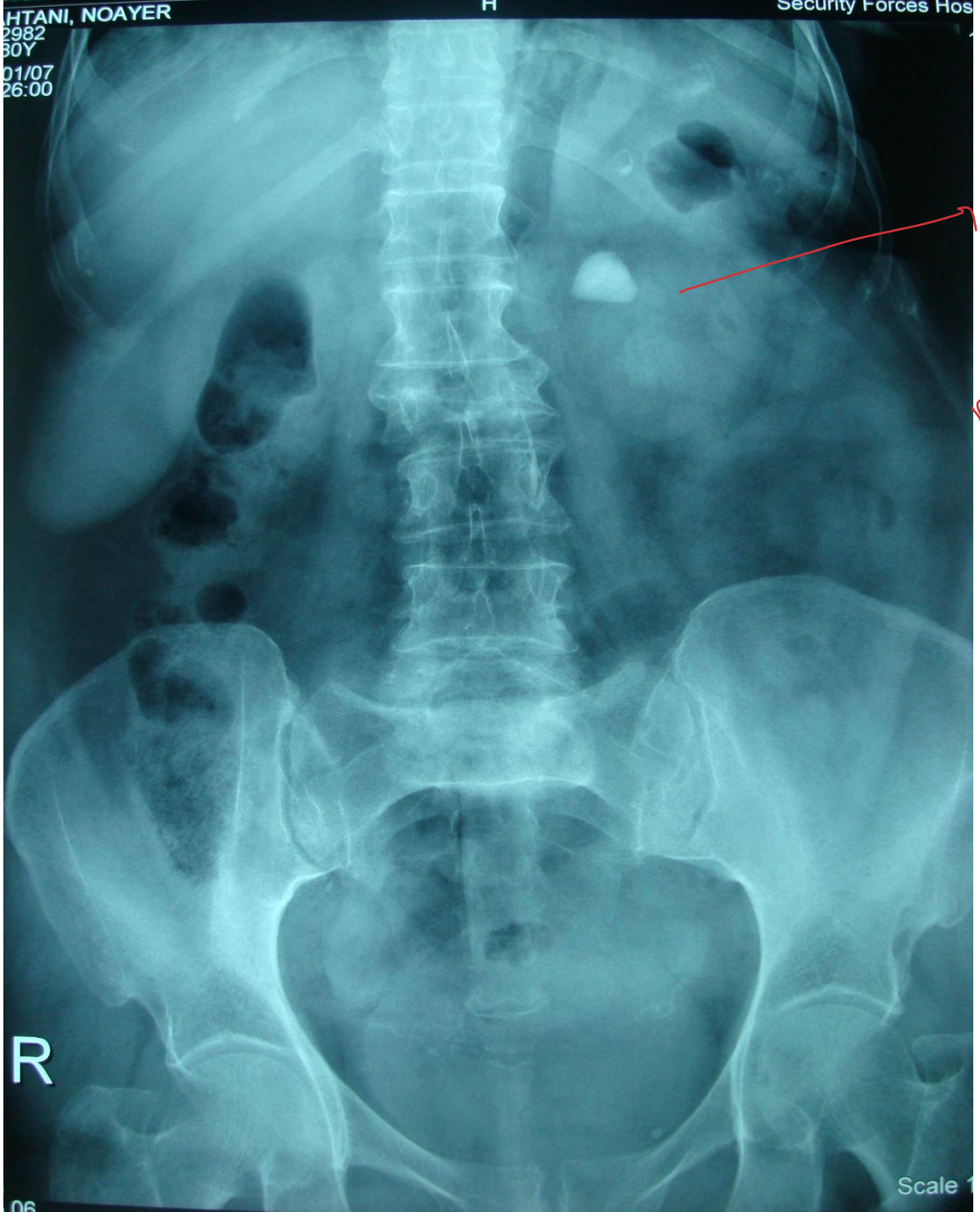
URINARY TRACT CALCULI

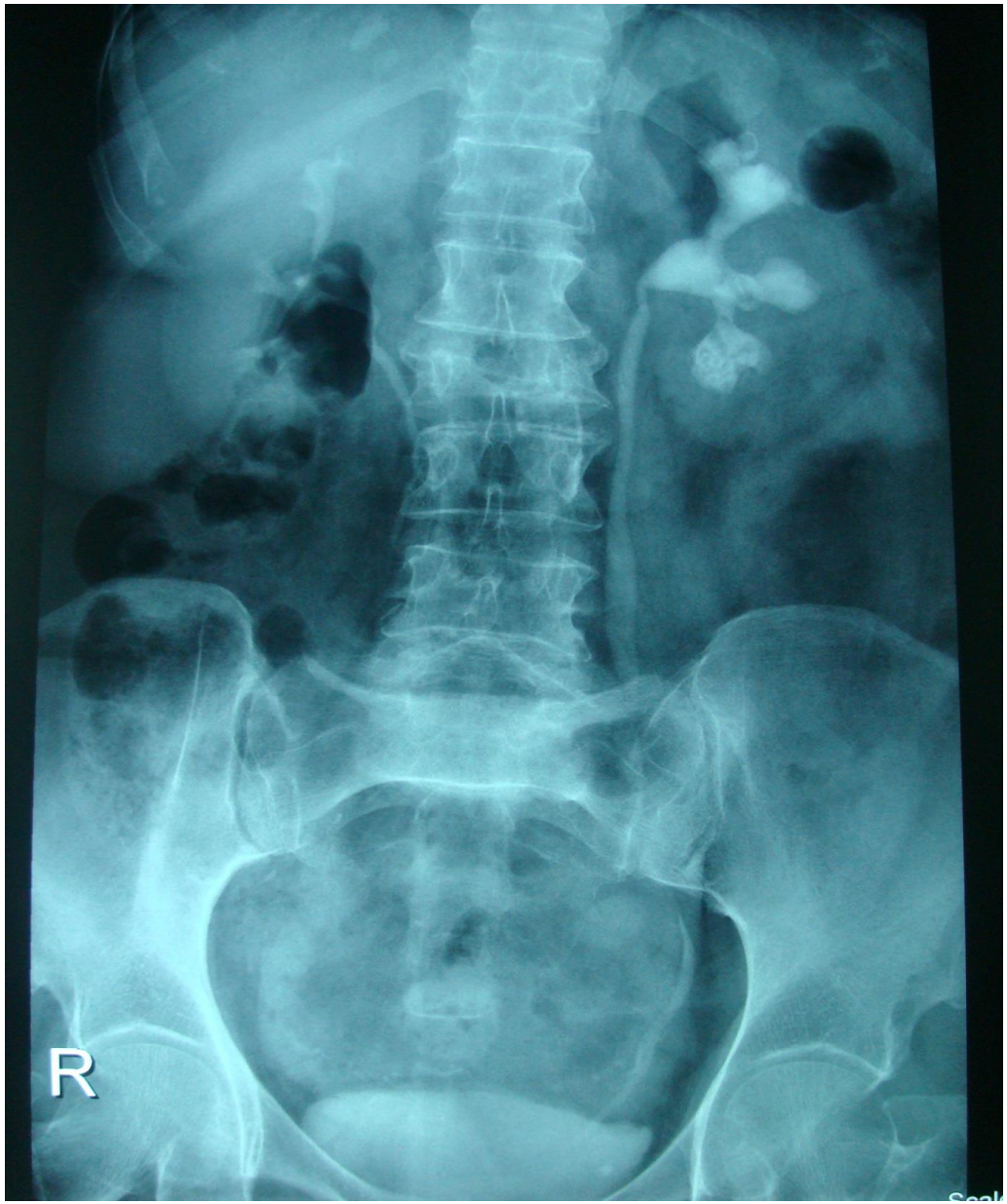
- The majority of renal stones are composed of calcium (about 90 %) and are visible on plain film (radio-opaque) .
- Stones composed of uric acid are not visible on plain film (radiolucent) .
- Stones composed of cystine are minimally dense on plain film (semi-opaque) .

URINARY TRACT CALCULI /2

What is the initial imaging test usually ordered to find urinary tract stones ?

- ✓ Plain radiograph (**KUB**), because the majority of stones are radio-opaque
- ✓ Other calcifications may be confused with urinary tract stones such as a phlebolith in the pelvis , which is a venous calcification , often with a lucent center .


HTANI, NOAYER
2982
60Y
01/07
26:00
H
Security Forces Hos
R
Scale 1
06
Stone
in the
Pelvo-uretric
Junction



IVU
مادة ملونة
بالوريد
بتخرج
من الكلى

They are linked to urease-producing bacterial infections and, hence, known as struvite infection stones.

Post voiding

INTRAVENOUS UROGRAPHY (IVU) british
INTRAVENOUS PYELOGRAPHY (IVP) american

Is a radiological procedure used to visualized abnormalities of the urinary system, including the kidneys, ureters, and bladder by using intravenous contrast.

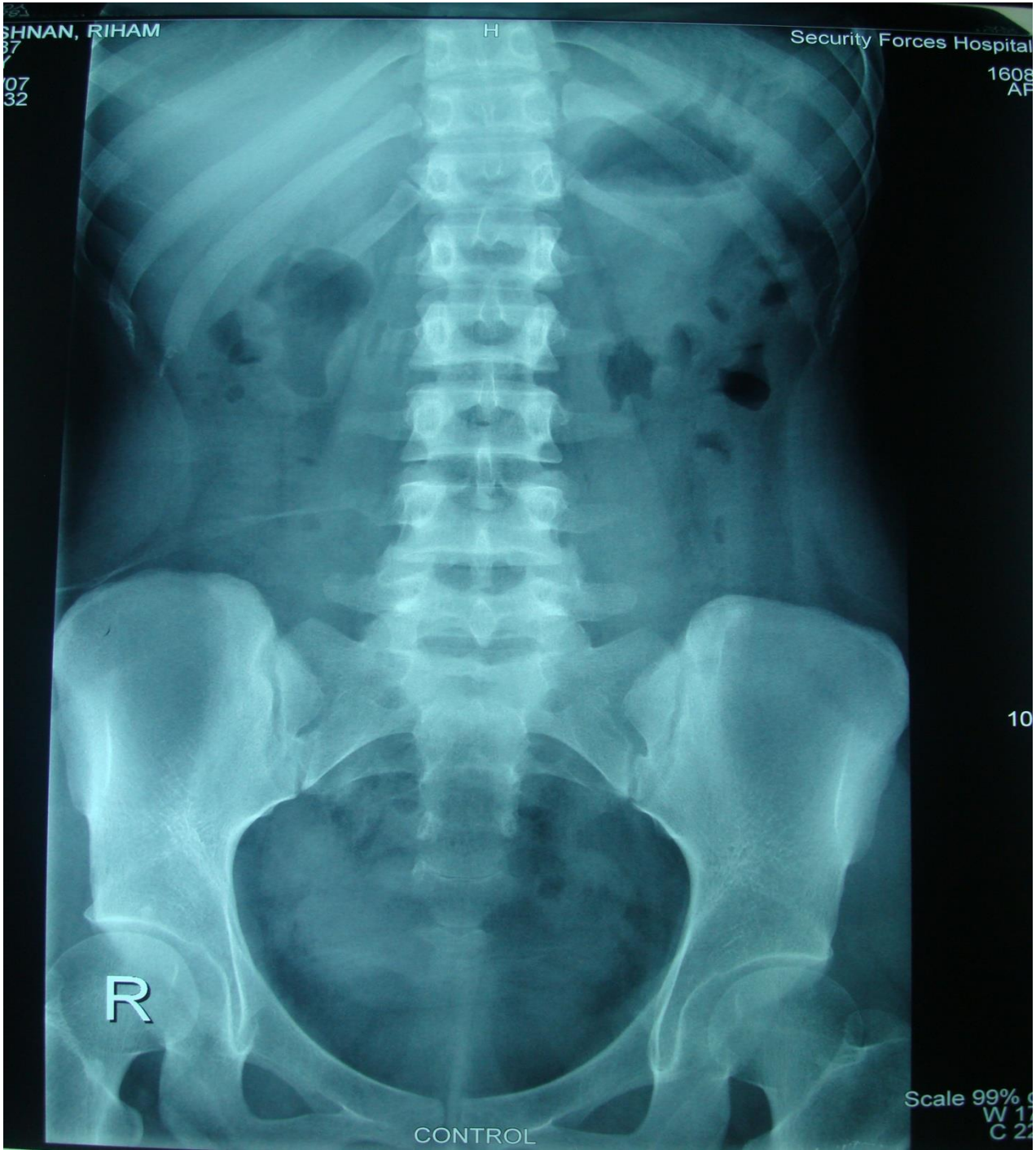
Indication:

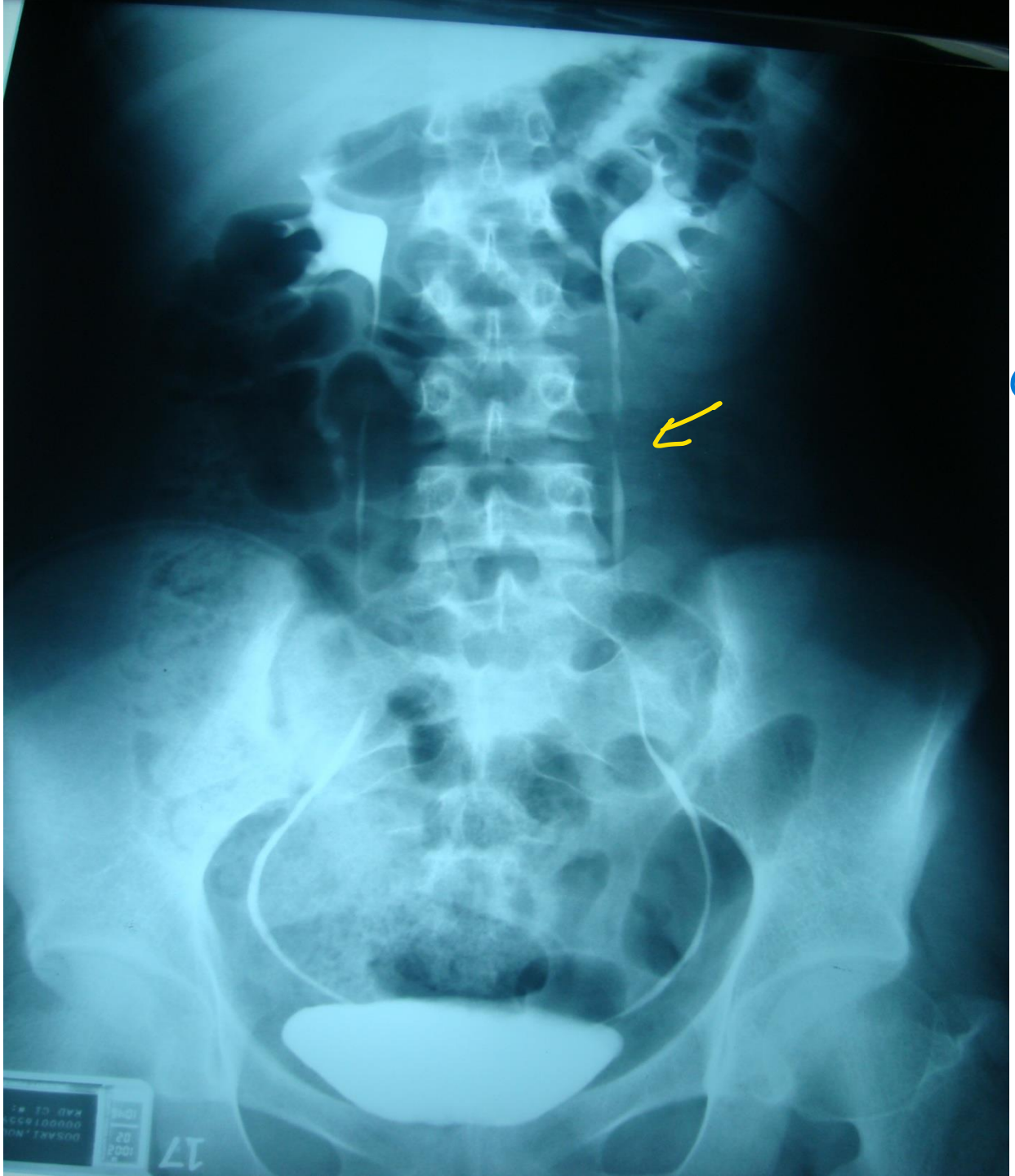
- Haematuria
- Renal colic or calculi
- Suspected stone in the ureters
- Renal trauma

1 cc / kg till 100 ml
in children → 1.5 cc

IVU /CONTINUATION

- After a preliminary control film of the abdomen, ~~50ml~~ of contrast medium is injected intravenously.
- Contrast is excreted by glomerular filtration.
- Films after 5, 10, and 15 minutes are taken and reveal contrast in the pelvi-calyceal systems, ureters, and in the bladder.
- Post-micturition film is taken to assess bladder residual volume.
  - normal < 50 ml
  - abnormal > 200 ml
- Renal obstruction may require a delayed films.


SHNAN, RIHAM
Security Forces Hospital
R
CONTROL

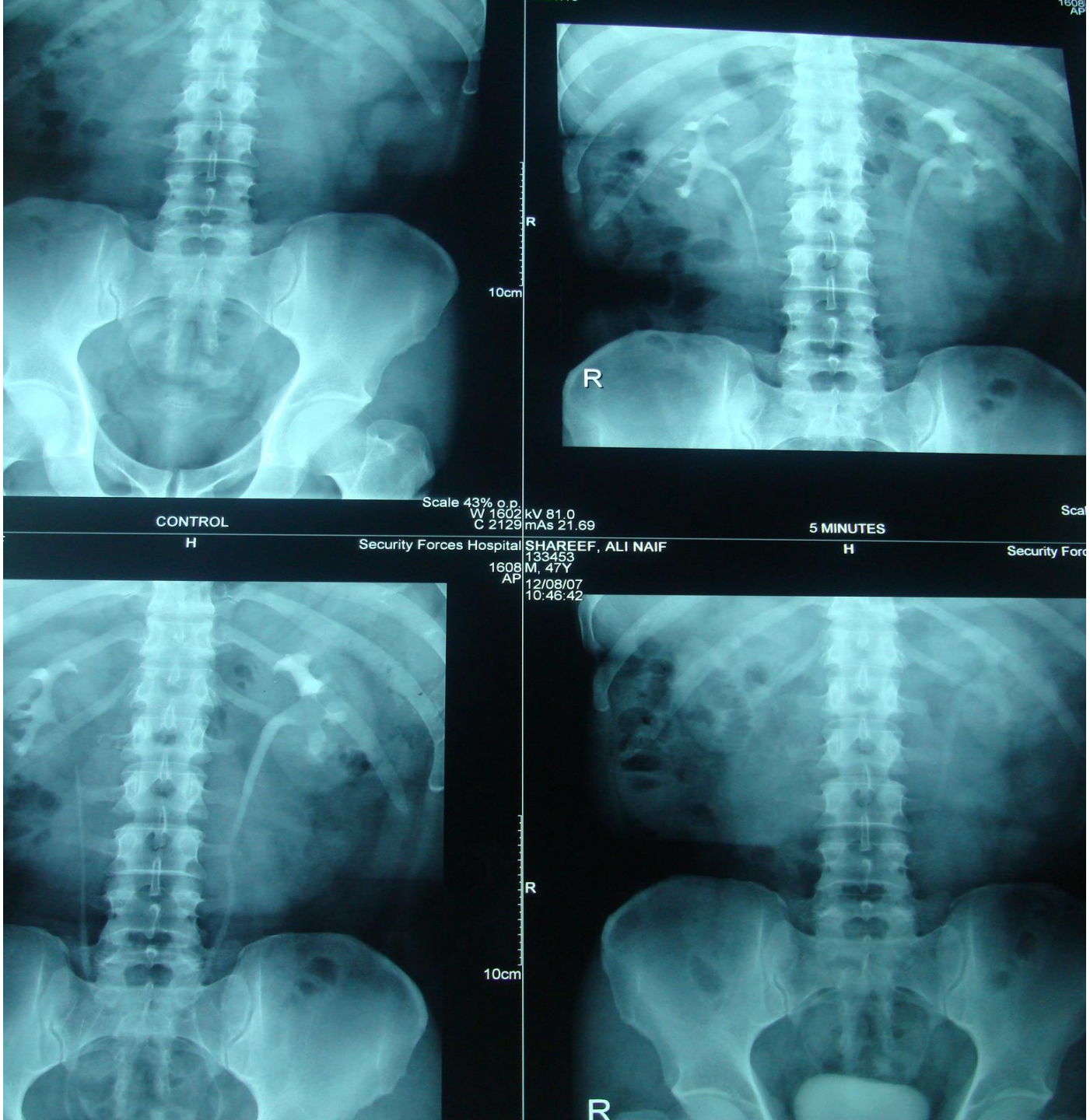


peristalsis not stricture

دليل

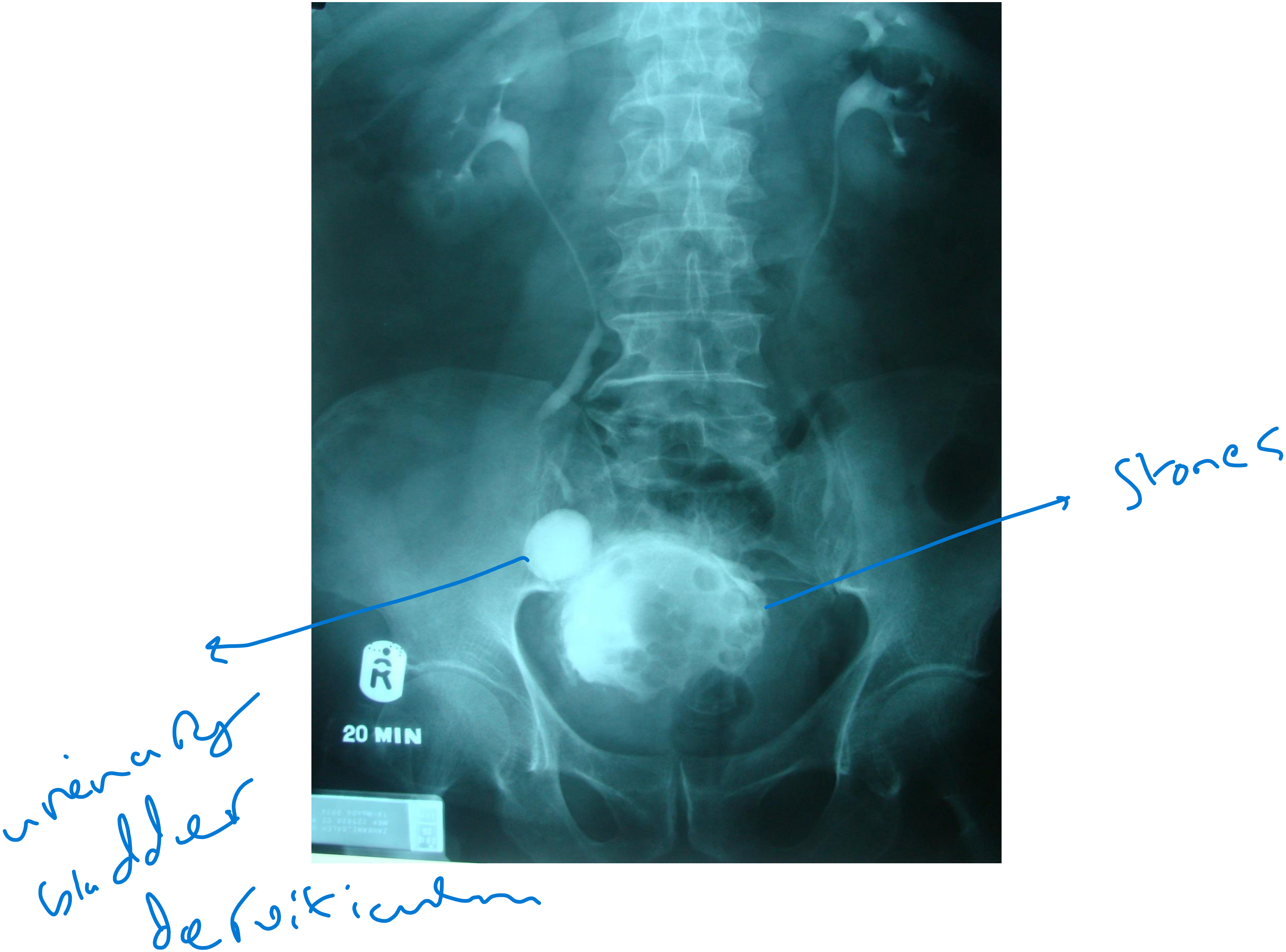
① not present in all films

② contrast passed through it


R
10cm
Scale 43% o.p.
W 1602 kV 81.0
C 2129 mAs 21.69
CONTROL
H
Security Forces Hospital
SHAREEF, ALI NAIF
133453
1608 M, 47Y
AP
12/08/07
10:46:42
5 MINUTES
H
Security Forc
R
10cm
R

Control

multiple well defined filling defect = multiple stones

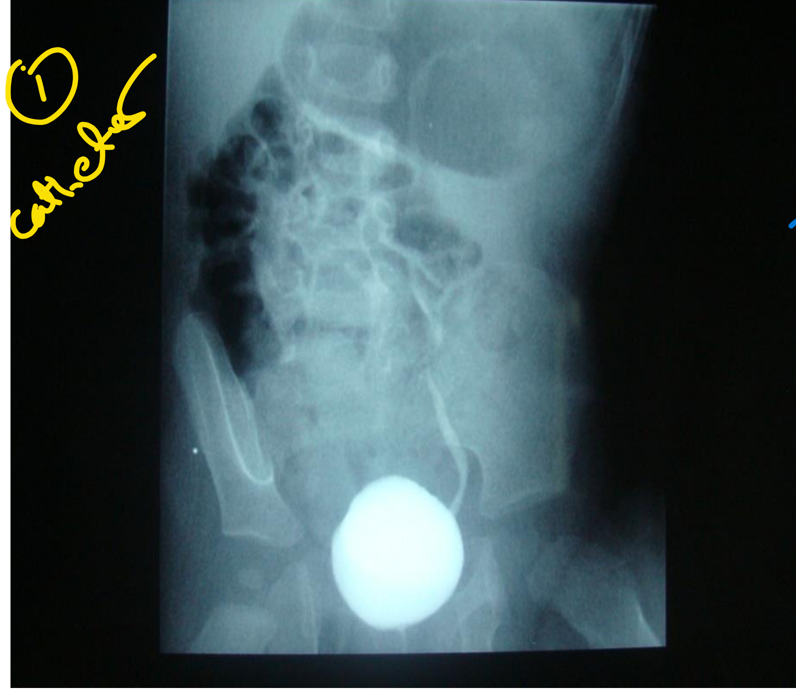


Stones
urinary bladder diverticulum
20 MIN

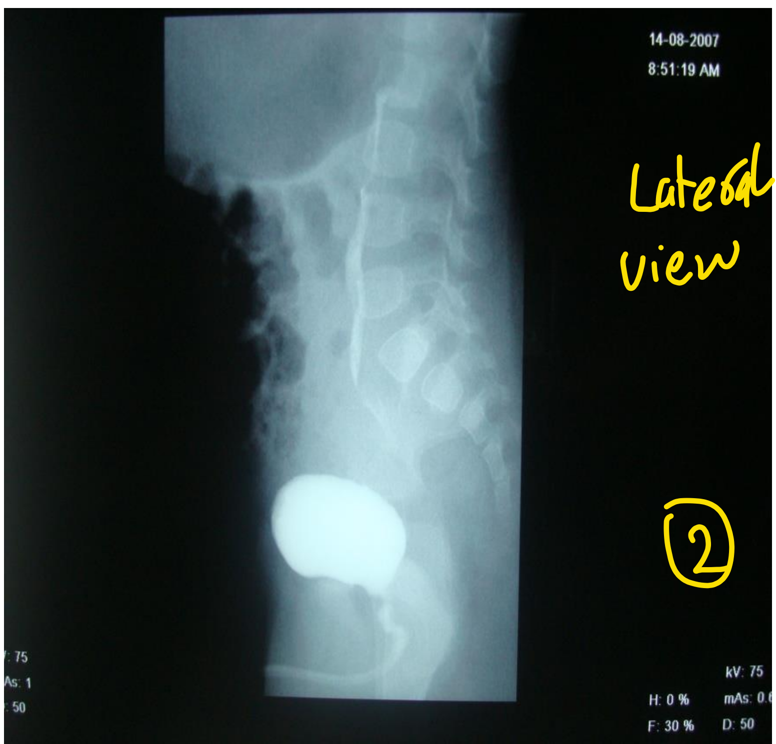
MICTURATING CYSTOGRAM

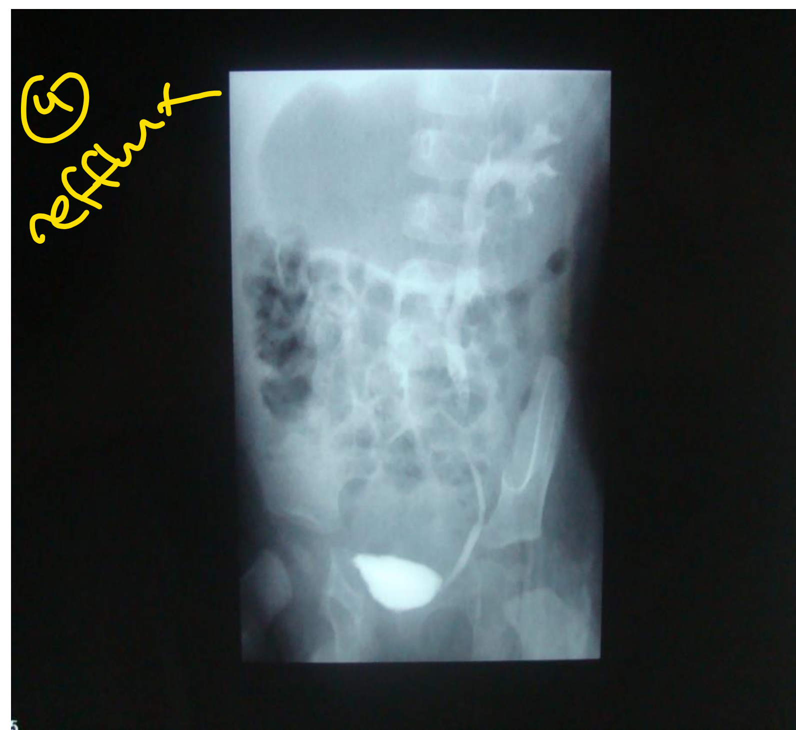
urethro
↓
MCUG

- Is the study of the urinary bladder and urethra with contrast medium.
- The bladder is filled with contrast via a urethral catheter. Films of the bladder are obtained.
- After removal of the catheter, patient is asked to void and films are taken during micturation to assess the bladder neck and urethra, as well as reflux.
- Examination of the urethra in oblique position is necessary, particularly in suspected posterior urethral valves in infants and small children, as they are usually only demonstrated during micturation.



Lt sided vesico uretric reflux





URETHROGRAM

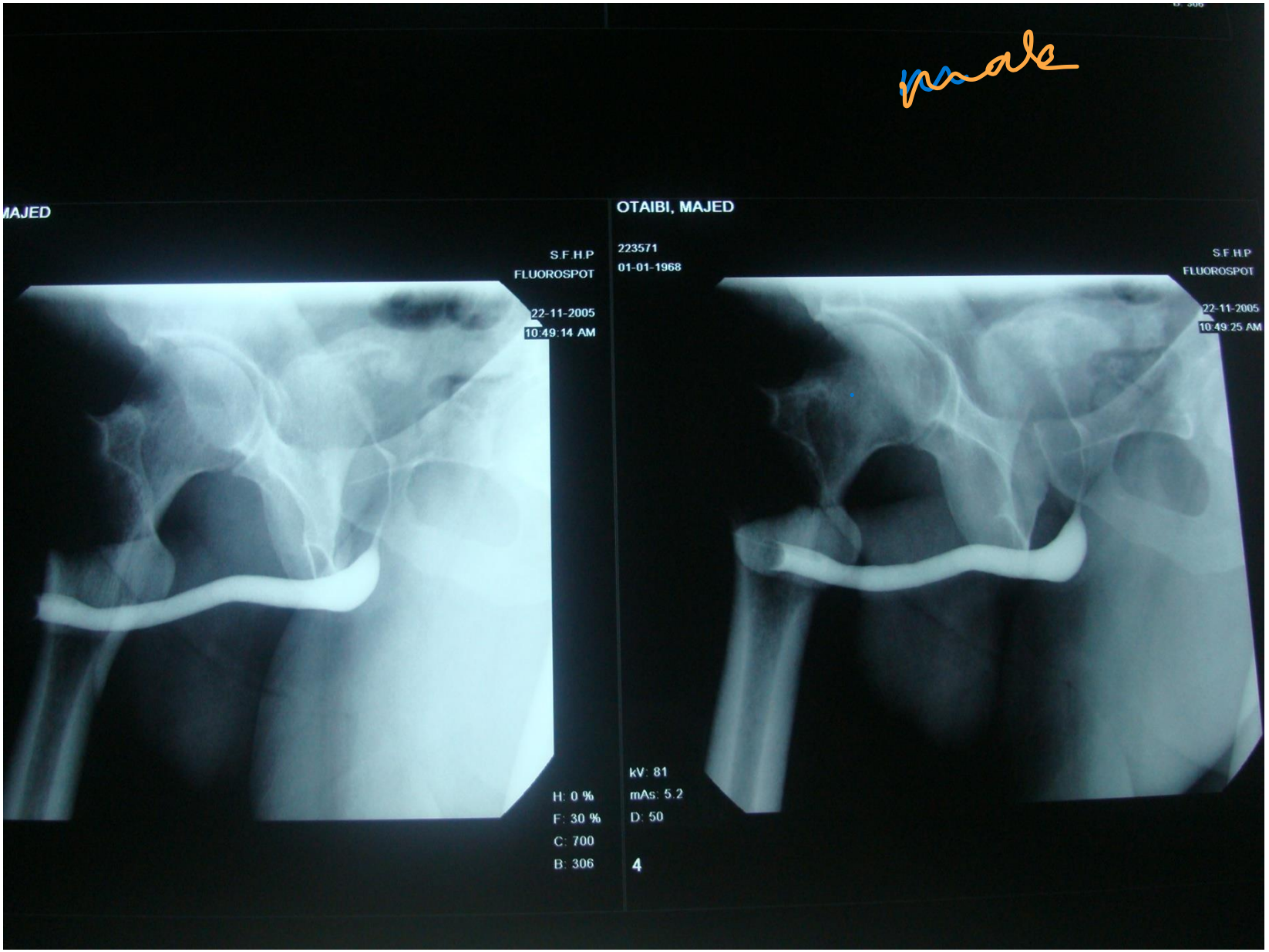
the most common cause of infection in males
west → STD
east → catheter

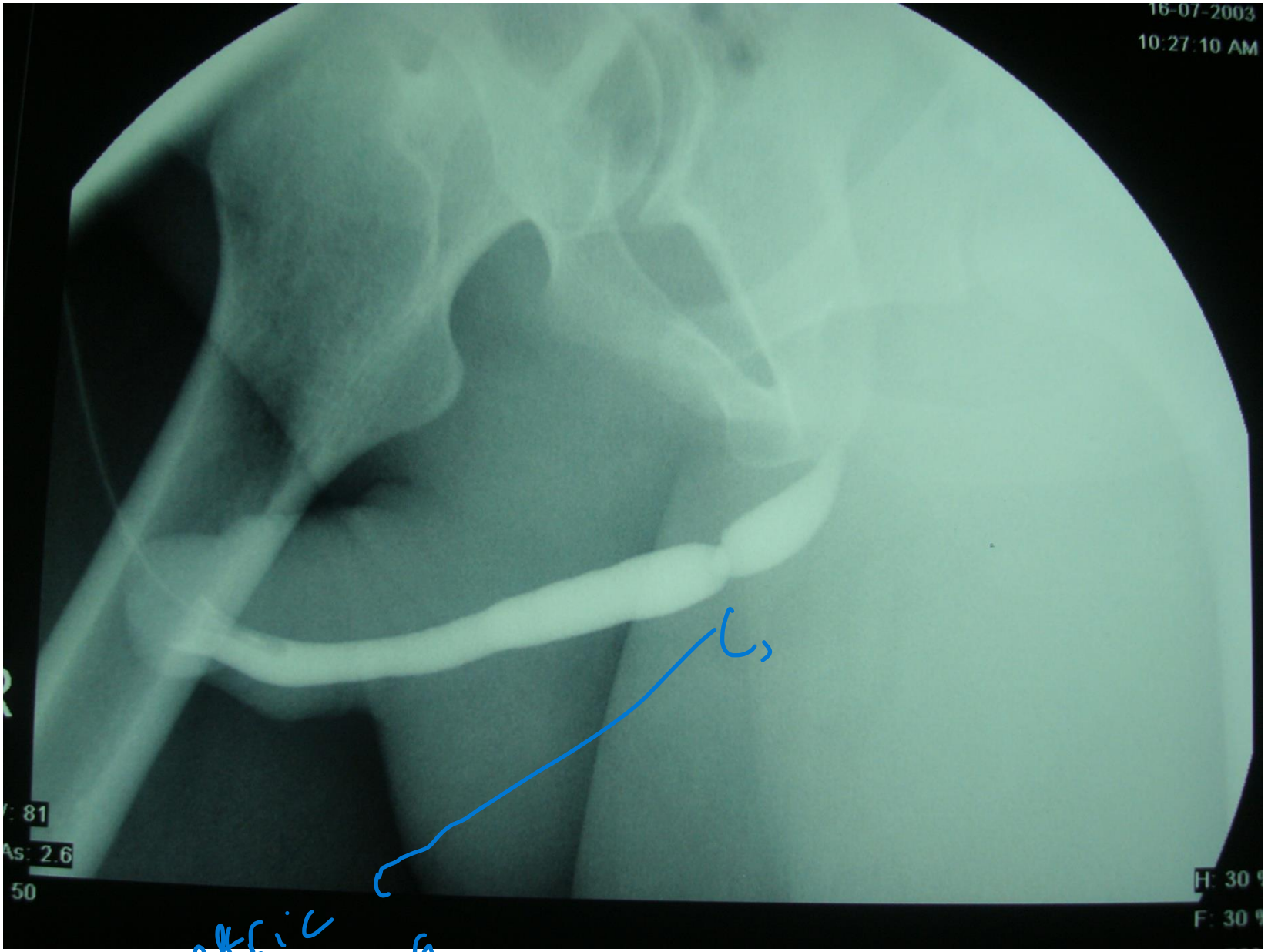
- in females urethra length is only 4 cm → sterile during

- The adult male urethra can be studied by ascen urethrogram.
- Contrast is injected through foley catheter inser the meatus, and its balloon inflated with 1 to 2ml sterile water placed in the navicular fossa.
- Films are taken to the urethra in oblique positio contrast injection.
- The most common indication for urethrogam is strictures.

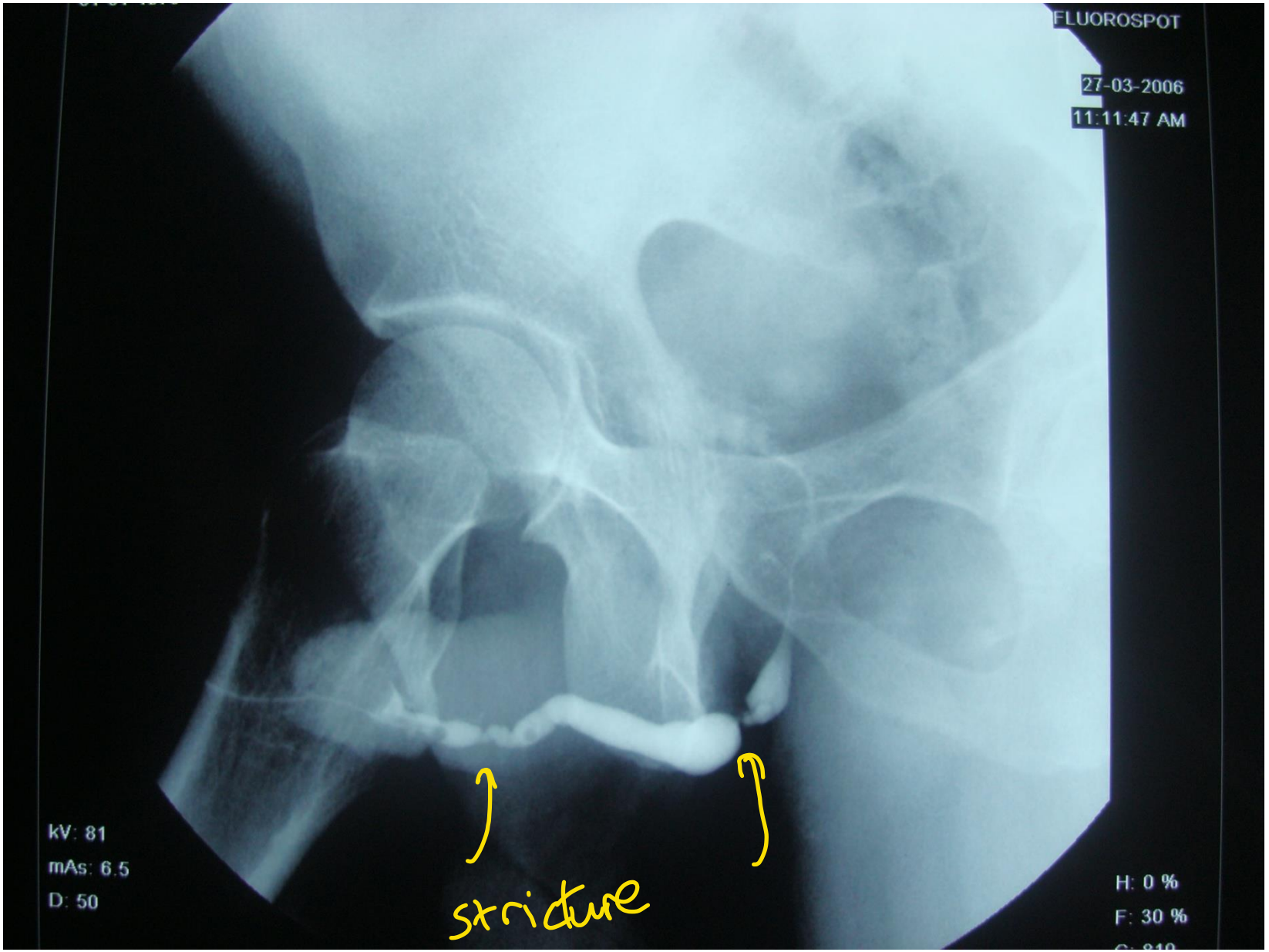
urethral

male


MAJED
S.F.H.P
FLUOROSPOT
22-11-2005
10:49:14 AM
H: 0 %
F: 30 %
C: 700
B: 306
OTAIBI, MAJED
223571
01-01-1968
S.F.H.P
FLUOROSPOT
22-11-2005
10:49:25 AM
kV: 81
mAs: 5.2
D: 50
4



uretric stricture / stenosis


FLUOROSPOT
27-03-2006
11:11:47 AM
kV: 81
mAs: 6.5
D: 50
H: 0 %
F: 30 %
stricture

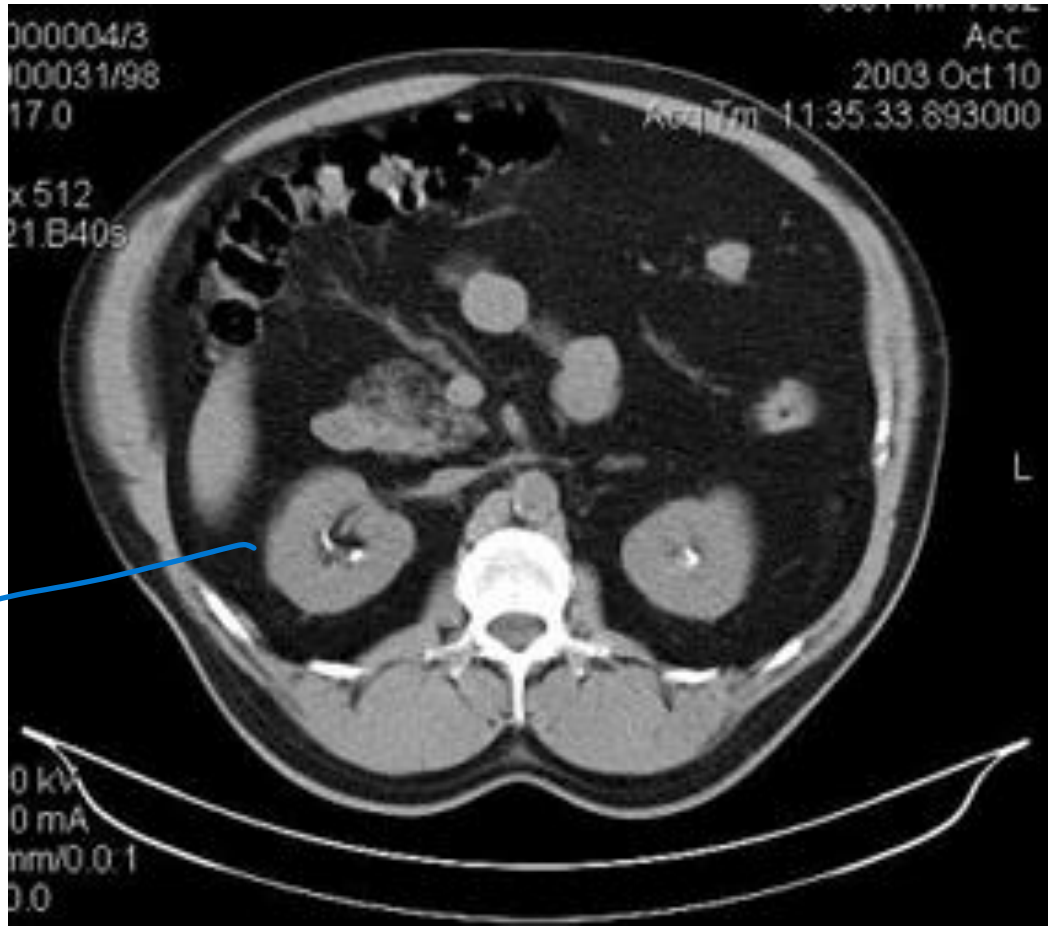
URINARY TRACT STONES AND CT

What is the most sensitive radiological test for urinary tract stone ?

CT , performed without intravenous contrast, is highly sensitive for detecting urinary tract stone.

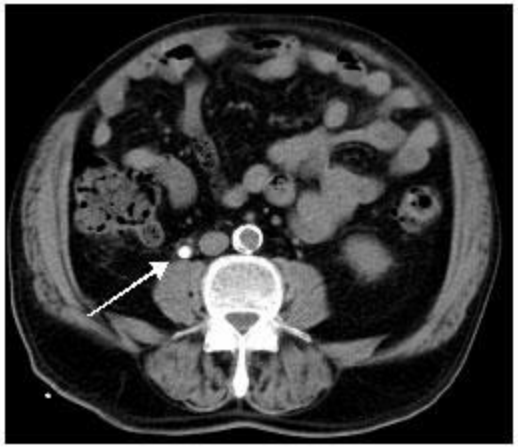
Are any urinary tract stones radiolucent on CT ?

No , virtually all urinary tract stones , regardless of their composition are visible on CT .



stone in kidney

Stone in ureter



URINARY OBSTRUCTION

- Obstruction of the renal tract may occur at many sites.
- The most common causes are:

- Urinary tract stones.
- Urinary tract strictures.
- - Urinary tract tumors.
- - Prostatic hypertrophy or cancer.

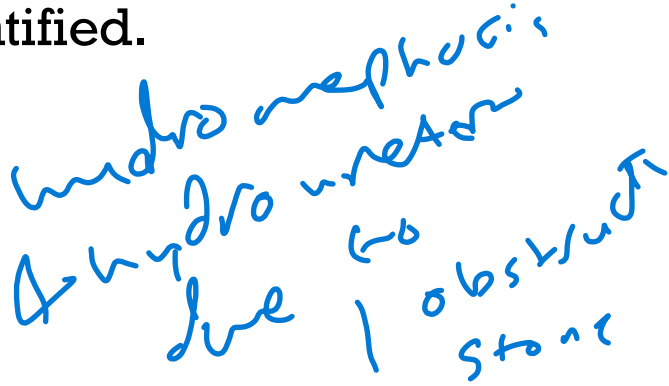
URINARY OBSTRUCTION / 2

Why is it important to recognize renal obstruction ?

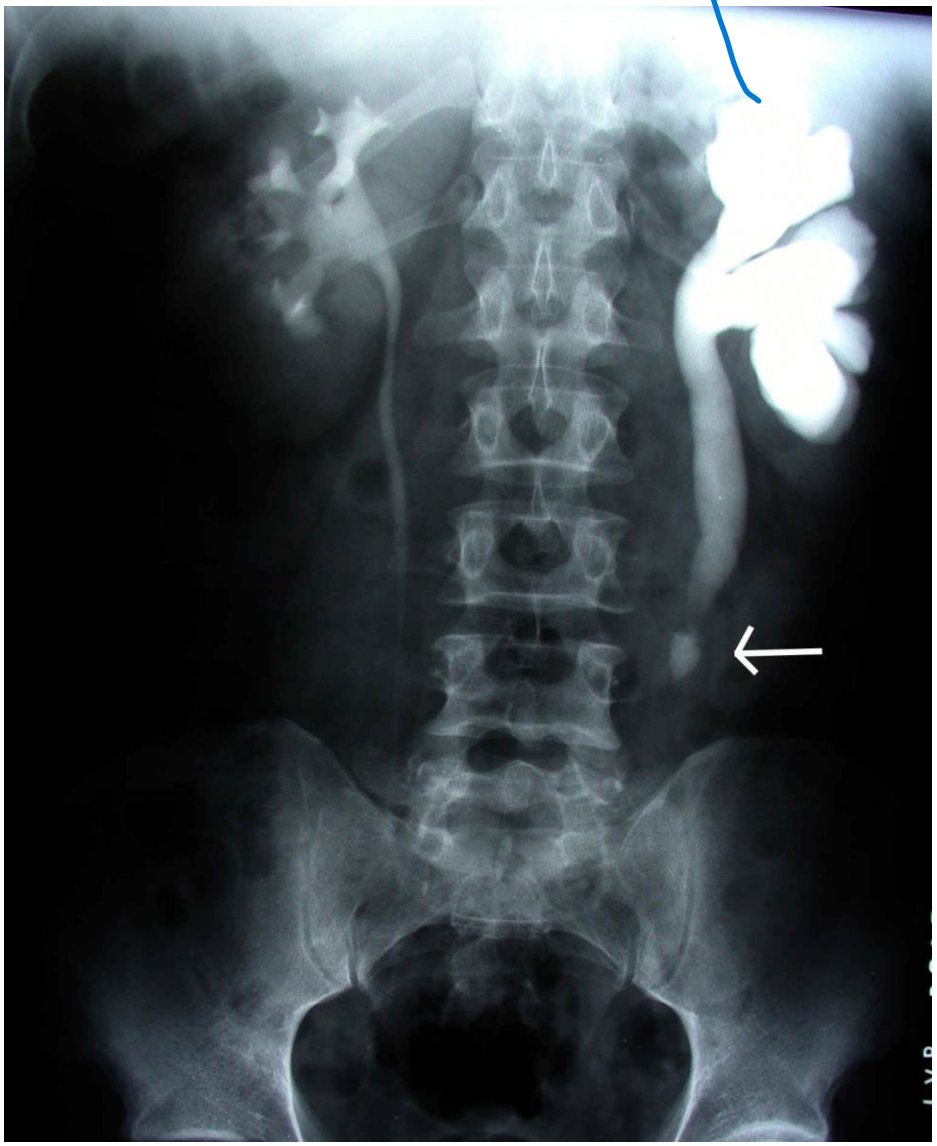
Because over time, obstructed kidneys may lose function permanently.

What is the best initial imaging test for suspected renal obstruction ?

Ultrasound. It is relatively inexpensive, save, and effective. The cause of obstruction also may be identified.



plain KUB



IVU

Lordosis

IVU

mass lesion in bladder

BENIGN RENAL LESIONS

What is the most common renal mass ?

The most common mass is a simple cyst.

- They are more common in older patients and are found in approximately 50% of the population over 50 years of age.
- They are usually cortical in position and an incidental finding.

BENIGN RENAL LESIONS /2

What is the best way to confirm that a renal mass is a simple cyst ?

Ultrasound.

- The ultrasound appearance of a simple cyst is that of a well-defined round mass with very thin wall, smooth margin and no internal echoes.

renal cyst

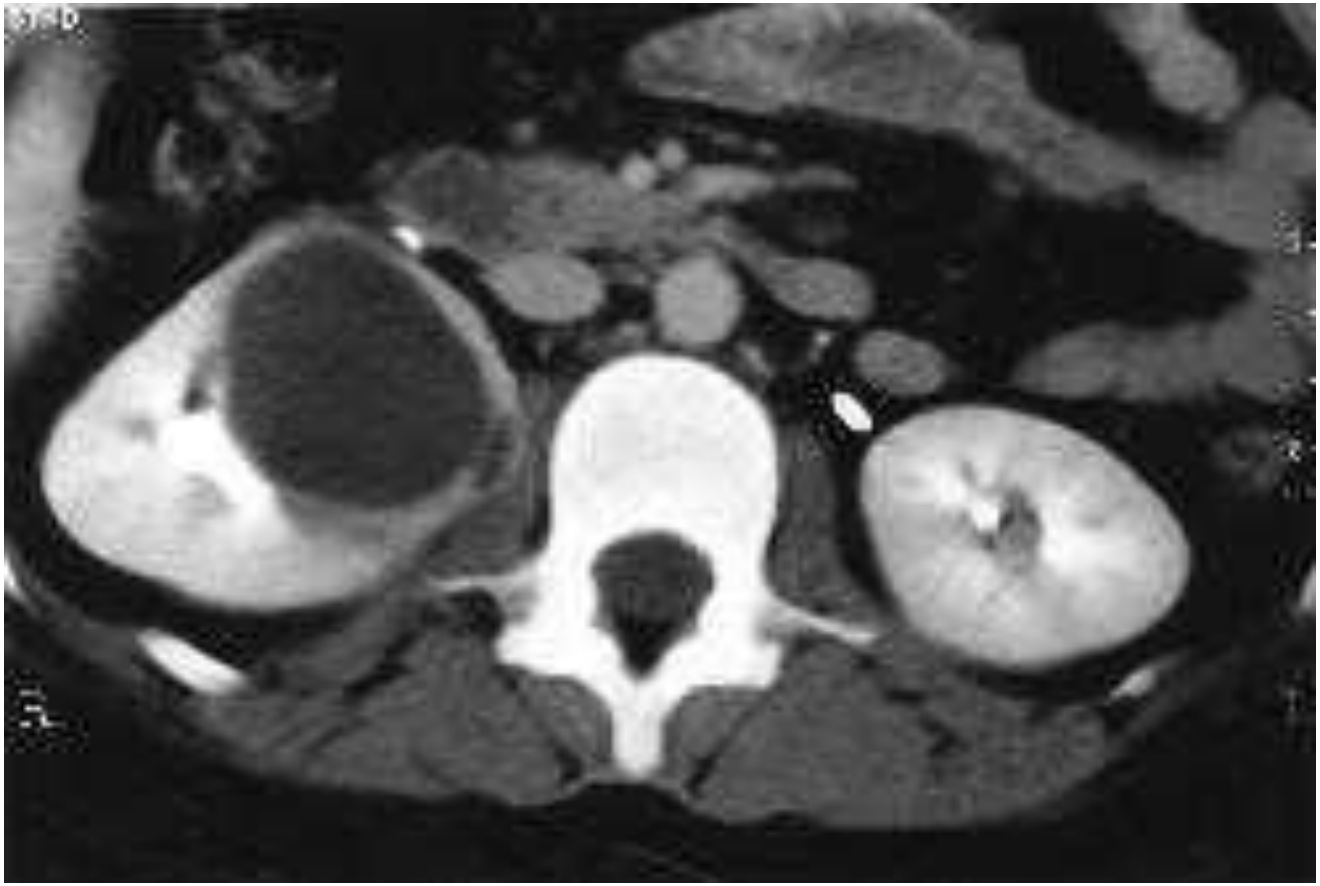
well defined round cyst

echoic

with fluid

no soft tissue

cyst in Rt kidney?



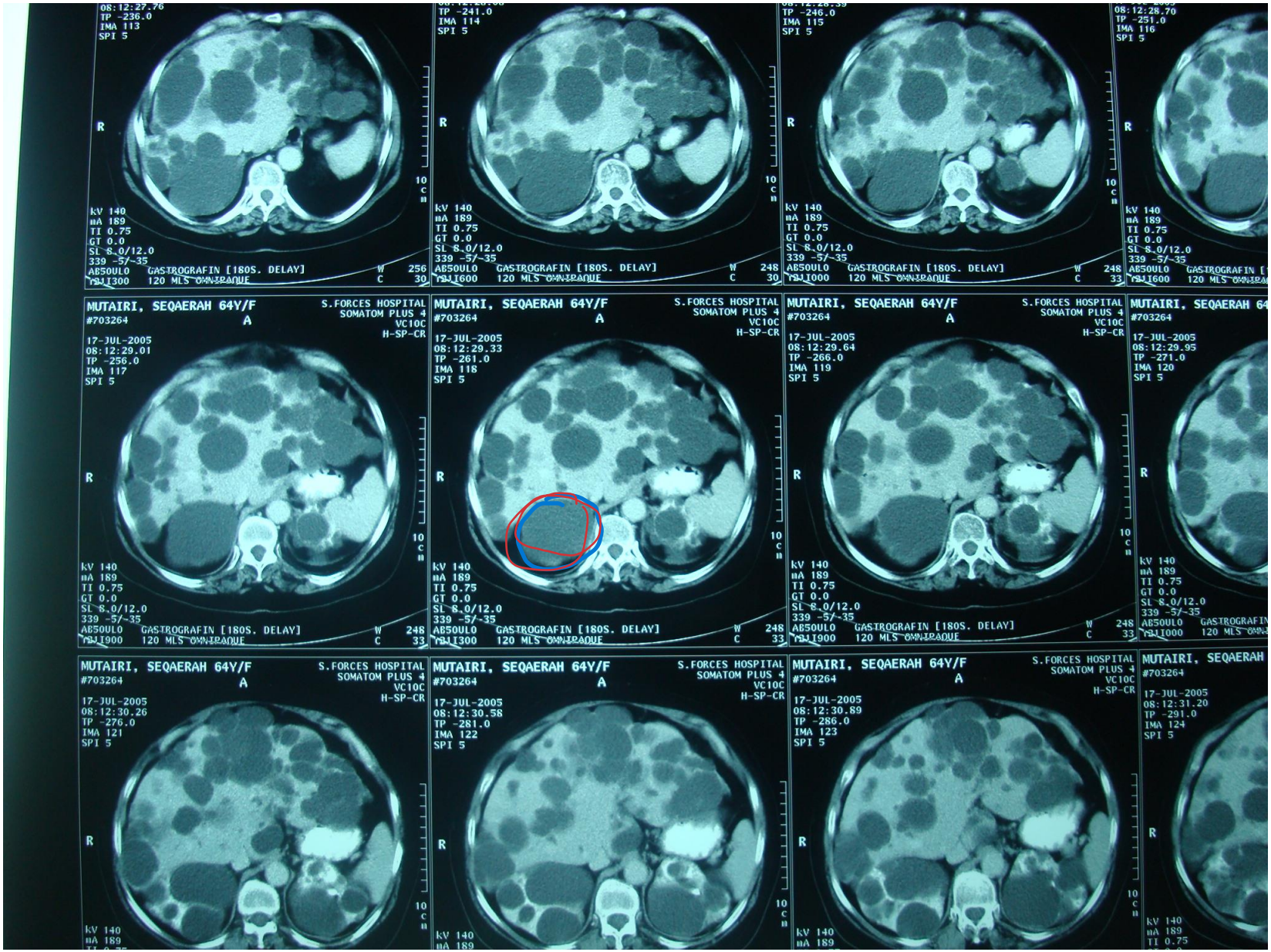
POLYCYSTIC KIDNEYS DISEASE

- Adult polycystic kidney disease is a congenital renal parenchymal disorder.
- Usually both kidneys are involved.
- In some cases, there is associated cysts in the liver and more rarely in the spleen and pancreas.

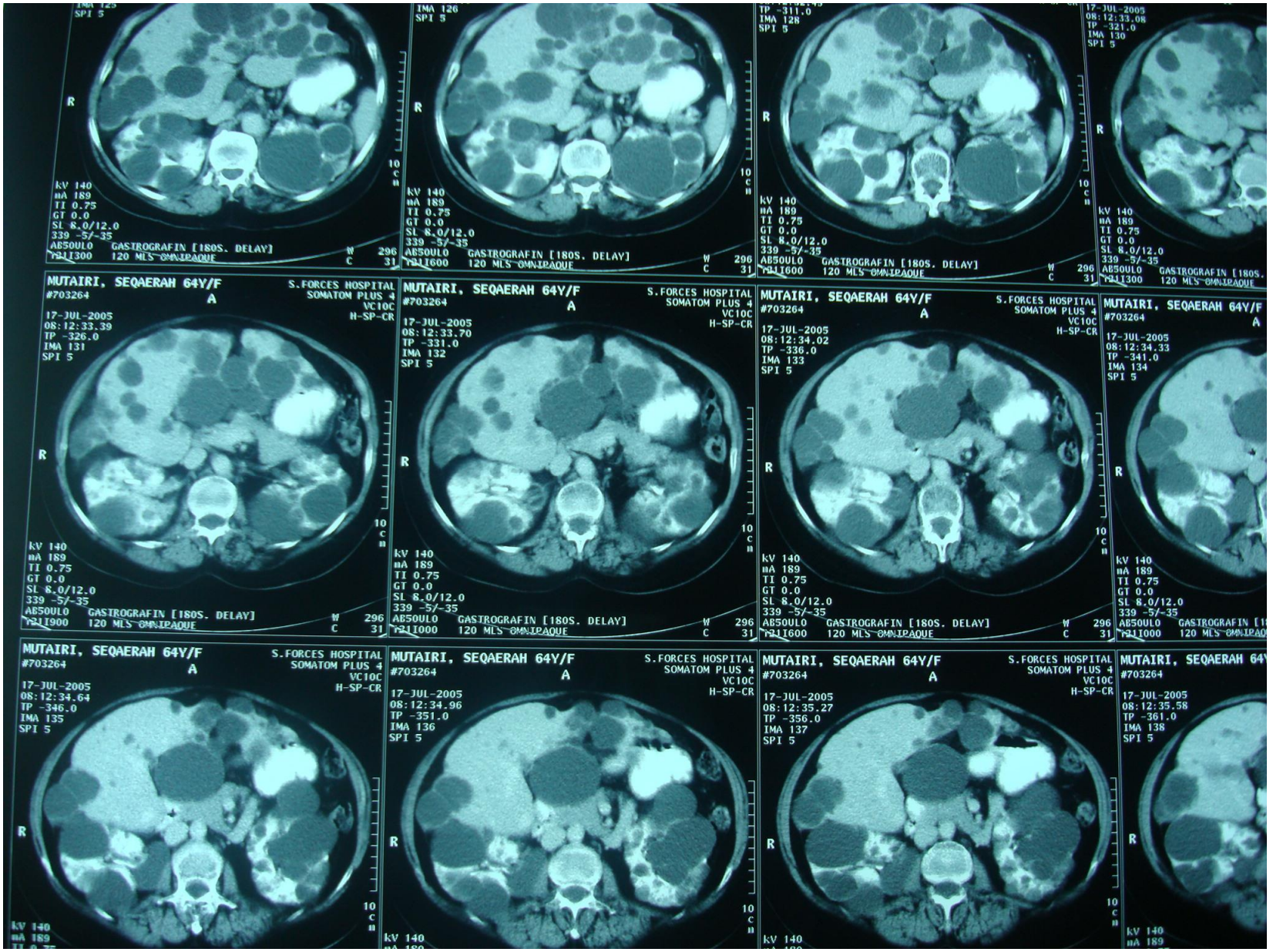
POLYCYSTIC KIDNEY DISEASE / 2

Radiological features on Ultrasound and CT:

- Kidneys are enlarged with lobulated contours.
- The renal parenchyma is replaced by multiple cysts of varying size, causing distortion of the collecting system.
- Spontaneous hemorrhage into some of the cysts may occur.



multiple cyst in both kidneys & liver & spleen

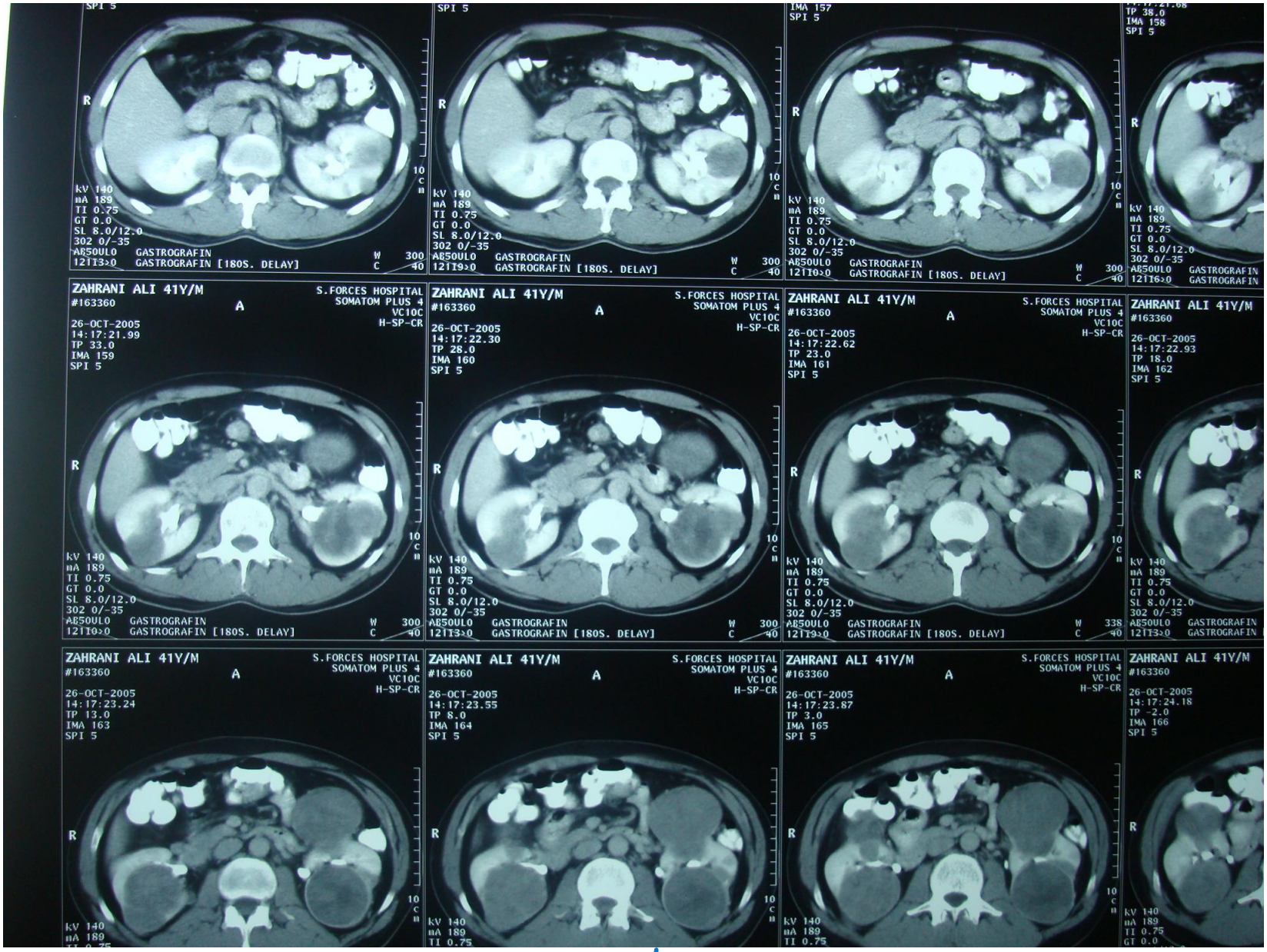

MUTAIRI, SEQAERAH 64Y/F
#703264
A
S.FORCES HOSPITAL
SOMATOM PLUS 4
VC10C
H-SP-CR
17-JUL-2005
08:12:33.39
TP -326.0
IMA 131
SPI 5
08:12:33.70
TP -331.0
IMA 132
08:12:34.02
TP -336.0
IMA 133
08:12:34.33
TP -341.0
IMA 134
08:12:34.64
TP -346.0
IMA 135
08:12:34.96
TP -351.0
IMA 136
08:12:35.27
TP -356.0
IMA 137
08:12:35.58
TP -361.0
IMA 138
kV 140
mA 189
TI 0.75
GT 0.0
SL 8.0/12.0
339 -5/-35
AB50UL0 GASTROGRAFIN [180S. DELAY]
120 MLS OMNIPAQUE
W 296
C 31
R
10 cm

MALIGNANT RENAL TUMORS

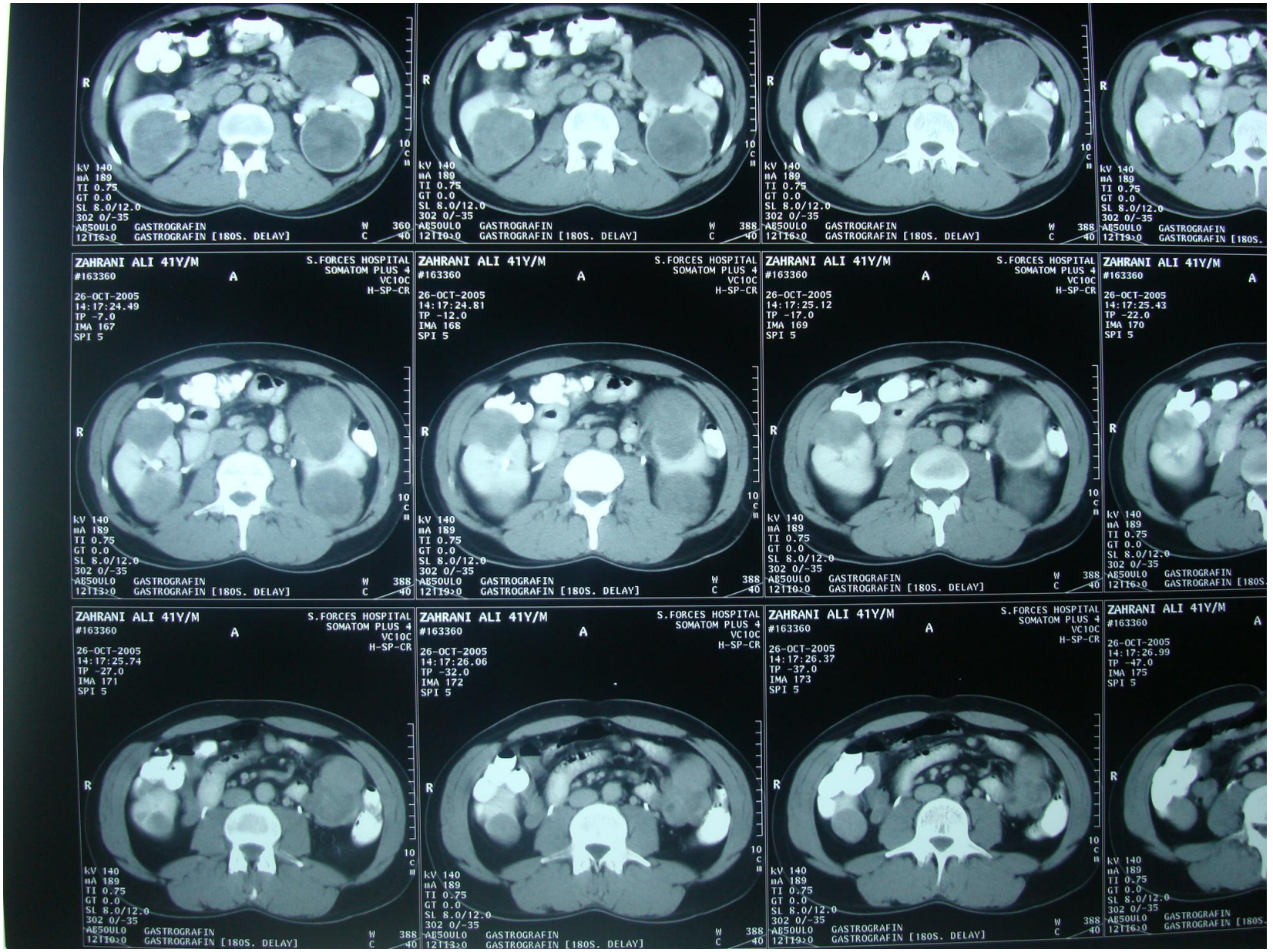
- **Renal cell carcinomas (RCC) or Hypernephroma:** account for 85% of renal tumors.
  - Are bilateral in 4% of cases.
  - Von Hippel- Lindau disease is associated with RCC in one third to one half of patients.
  - Patients with polycystic kidney disease and chronic renal failure may also be associated with RCC.
- **Transitional cell carcinoma:** are relatively rare and represent 7% of all renal tumors.

soft tissue


normal
mass in lt kidney
mets to IVC



Bilateral renal masses
Non-visible...


ZAHRANI ALI 41Y/M
#163360
A
S.FORCES HOSPITAL
SOMATOM PLUS 4
VC10C
H-SP-CR
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IMA 167
SPI 5
kV 140
mA 189
TI 0.75
GT 0.0
SL 8.0/12.0
302 0/-35
AB50ULO GASTROGRAFIN W 360
12TI6>0 GASTROGRAFIN [180S. DELAY] C 40
ZAHRANI ALI 41Y/M
#163360
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S.FORCES HOSPITAL
SOMATOM PLUS 4
VC10C
H-SP-CR
26-OCT-2005
14:17:24.81
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IMA 168
SPI 5
kV 140
mA 189
TI 0.75
GT 0.0
SL 8.0/12.0
302 0/-35
AB50ULO GASTROGRAFIN W 388
12TI9>0 GASTROGRAFIN [180S. DELAY] C 40
ZAHRANI ALI 41Y/M
#163360
A
S.FORCES HOSPITAL
SOMATOM PLUS 4
VC10C
H-SP-CR
26-OCT-2005
14:17:25.12
TP -17.0
IMA 169
SPI 5
kV 140
mA 189
TI 0.75
GT 0.0
SL 8.0/12.0
302 0/-35
AB50ULO GASTROGRAFIN W 388
12TI0>0 GASTROGRAFIN [180S. DELAY] C 40
ZAHRANI ALI 41Y/M
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26-OCT-2005
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kV 140
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302 0/-35
AB50ULO GASTROGRAFIN
12TI6>0 GASTROGRAFIN [180S.
ZAHRANI ALI 41Y/M
#163360
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S.FORCES HOSPITAL
SOMATOM PLUS 4
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H-SP-CR
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TI 0.75
GT 0.0
SL 8.0/12.0
302 0/-35
AB50ULO GASTROGRAFIN W 388
12TI0>0 GASTROGRAFIN [180S. DELAY] C 40
ZAHRANI ALI 41Y/M
#163360
A
S.FORCES HOSPITAL
SOMATOM PLUS 4
VC10C
H-SP-CR
26-OCT-2005
14:17:26.06
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IMA 172
SPI 5
kV 140
mA 189
TI 0.75
GT 0.0
SL 8.0/12.0
302 0/-35
AB50ULO GASTROGRAFIN W 388
12TI3>0 GASTROGRAFIN [180S. DELAY] C 40
ZAHRANI ALI 41Y/M
#163360
A
S.FORCES HOSPITAL
SOMATOM PLUS 4
VC10C
H-SP-CR
26-OCT-2005
14:17:26.37
TP -37.0
IMA 173
SPI 5
kV 140
mA 189
TI 0.75
GT 0.0
SL 8.0/12.0
302 0/-35
AB50ULO GASTROGRAFIN W 388
12TI9>0 GASTROGRAFIN [180S. DELAY] C 40
ZAHRANI ALI 41Y/M
#163360
A
26-OCT-2005
14:17:26.99
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IMA 175
SPI 5
kV 140
mA 189
TI 0.75
GT 0.0
SL 8.0/12.0
302 0/-35
AB50ULO GASTROGRAFIN
12TI6>0 GASTROGRAFIN [180S.

- Film from IVU study
- filling defect

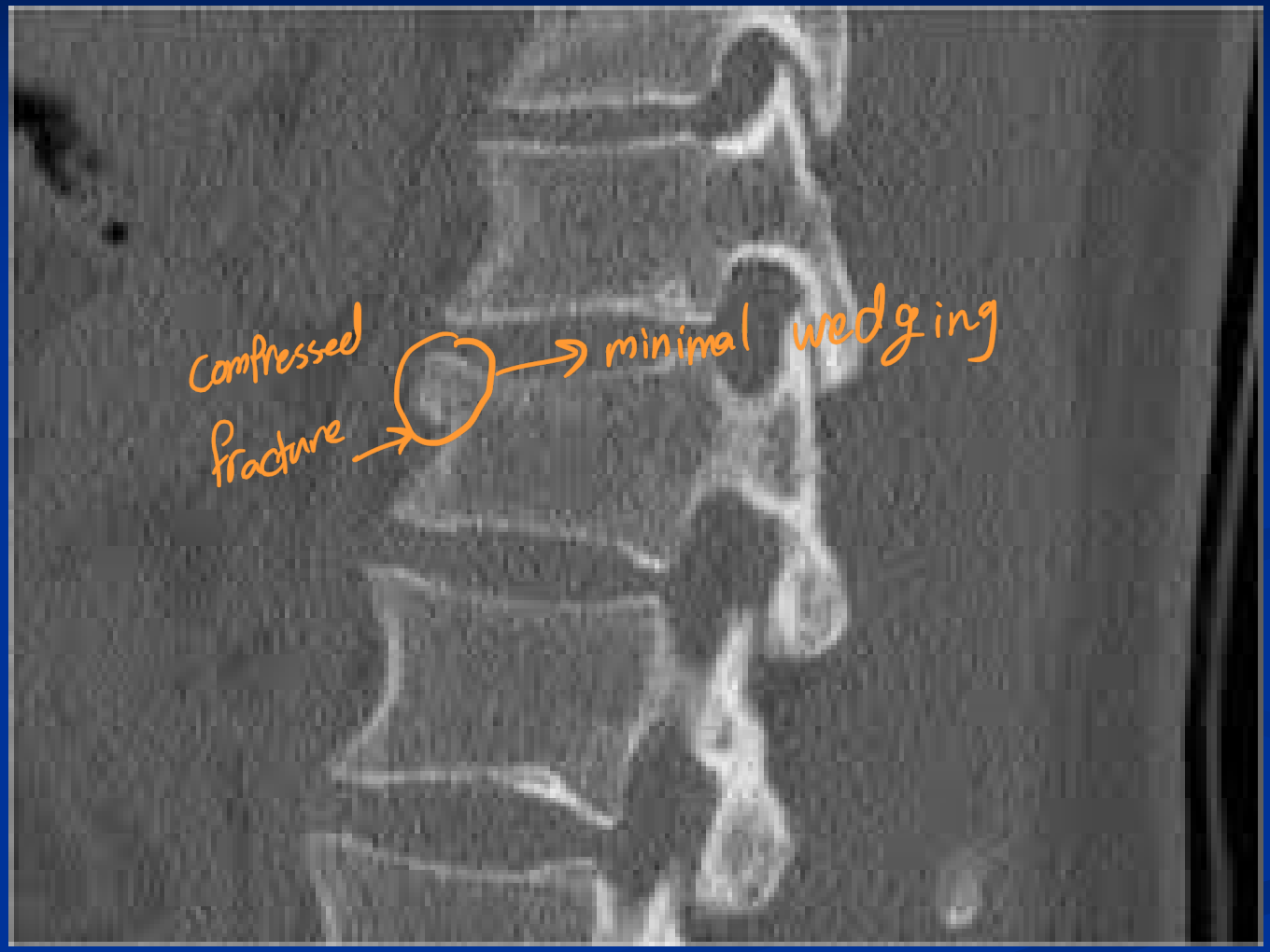
Trabiculated
- irregular
- tumor
- speculated

stone VS tumor

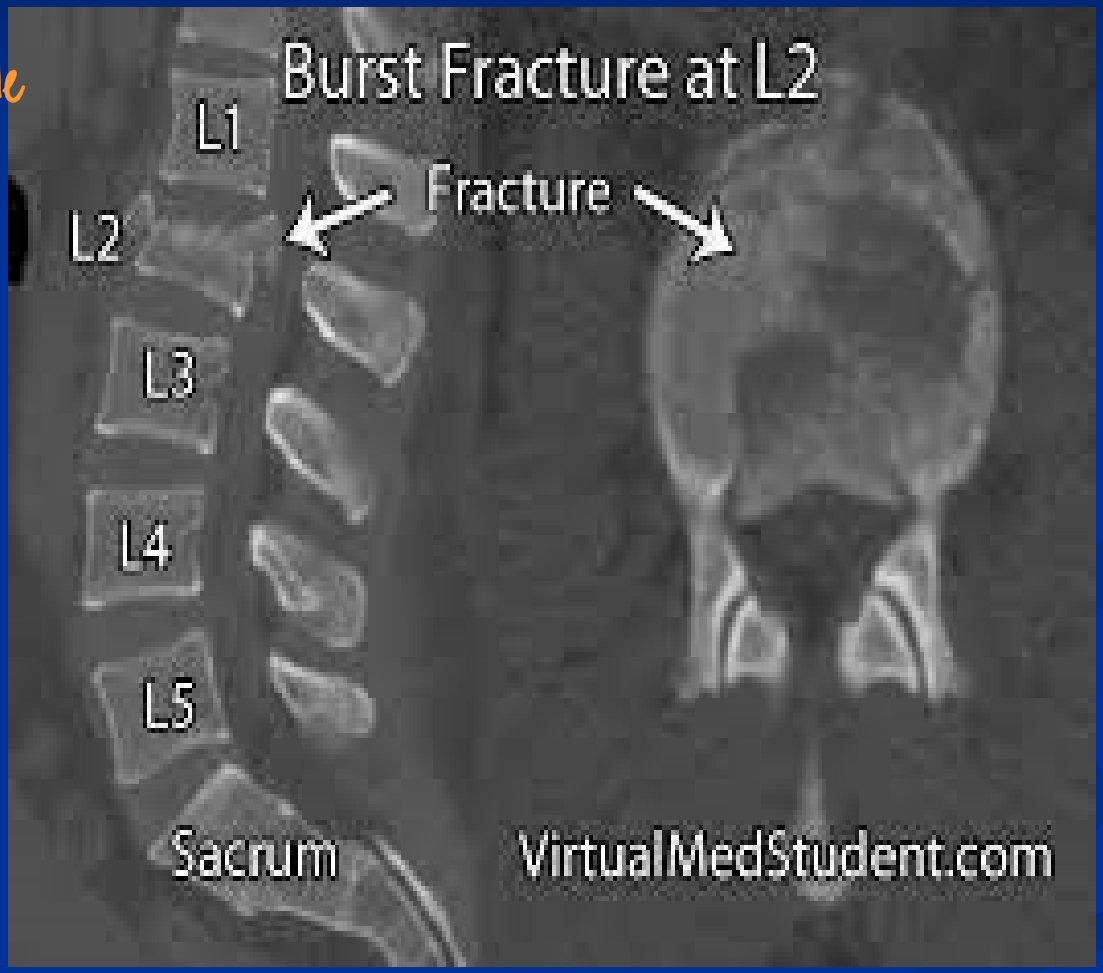
Contrast → enhancement → mass
→ no → cyst

bladder polyp → well defined, smooth as a stone

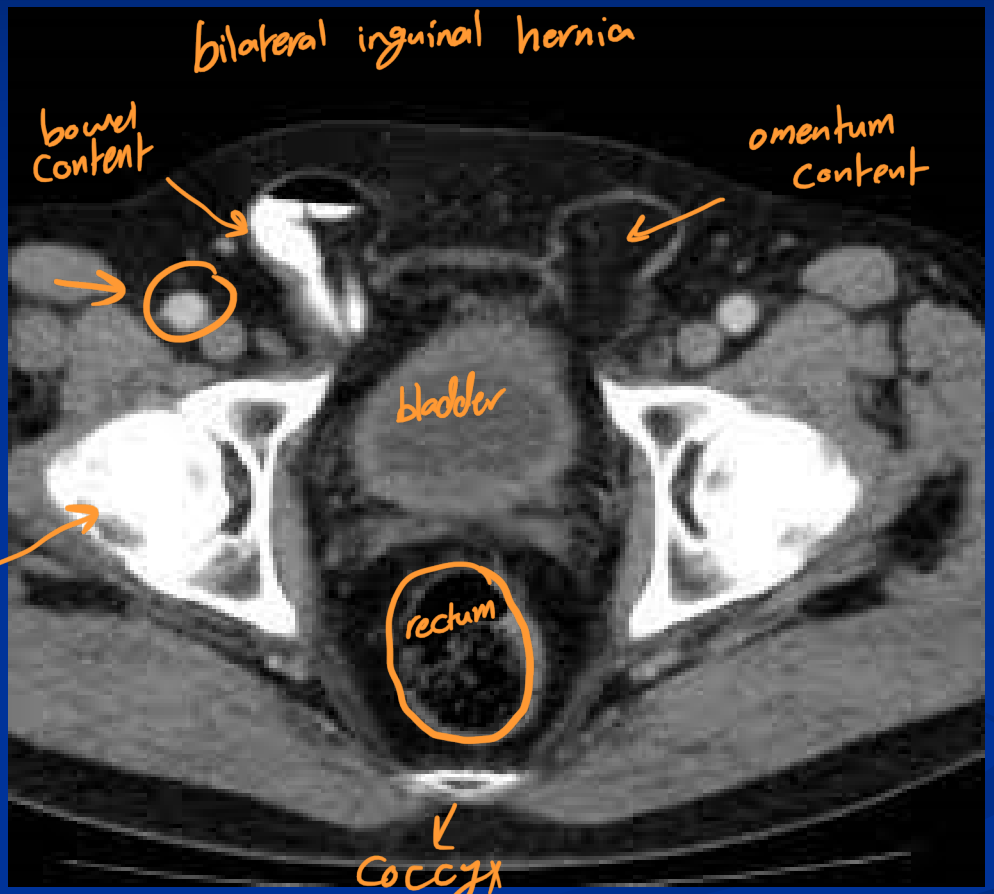
كيف نفرق؟ → CT → hyperdense → stone
→ polyp → isodense


Compressed fracture
minimal wedging

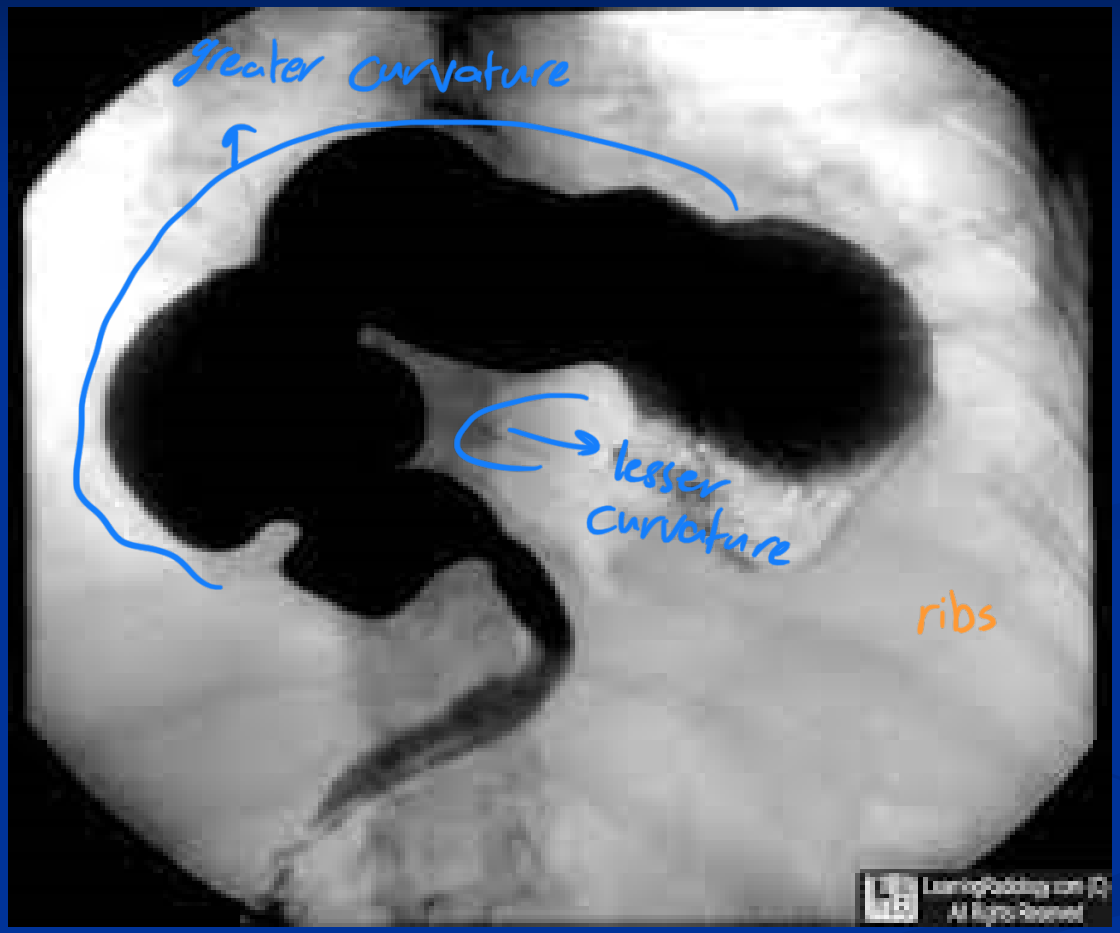
anterior + middle columns



axial abdominal CT scan with contrast



Organo axial gastric volvulus

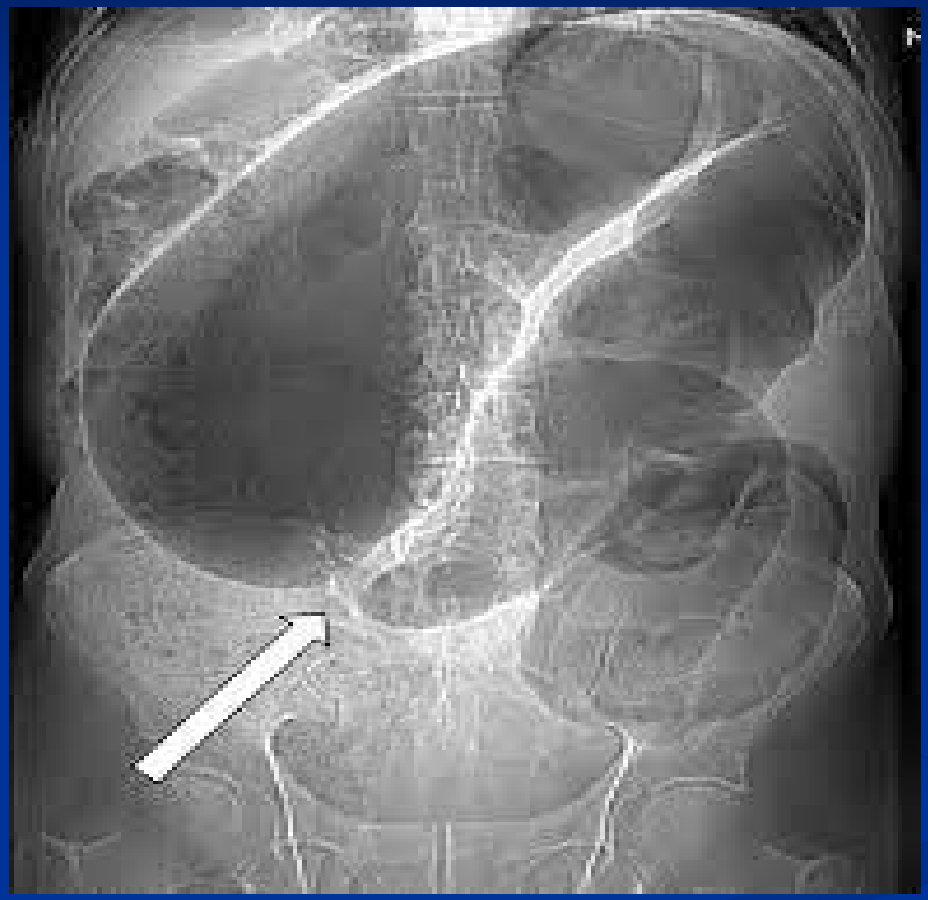


Barium meal (negative)

abdominal X-ray

Coffee bean sign

→sigmoid volvulus



RTA

- mediastinal shift

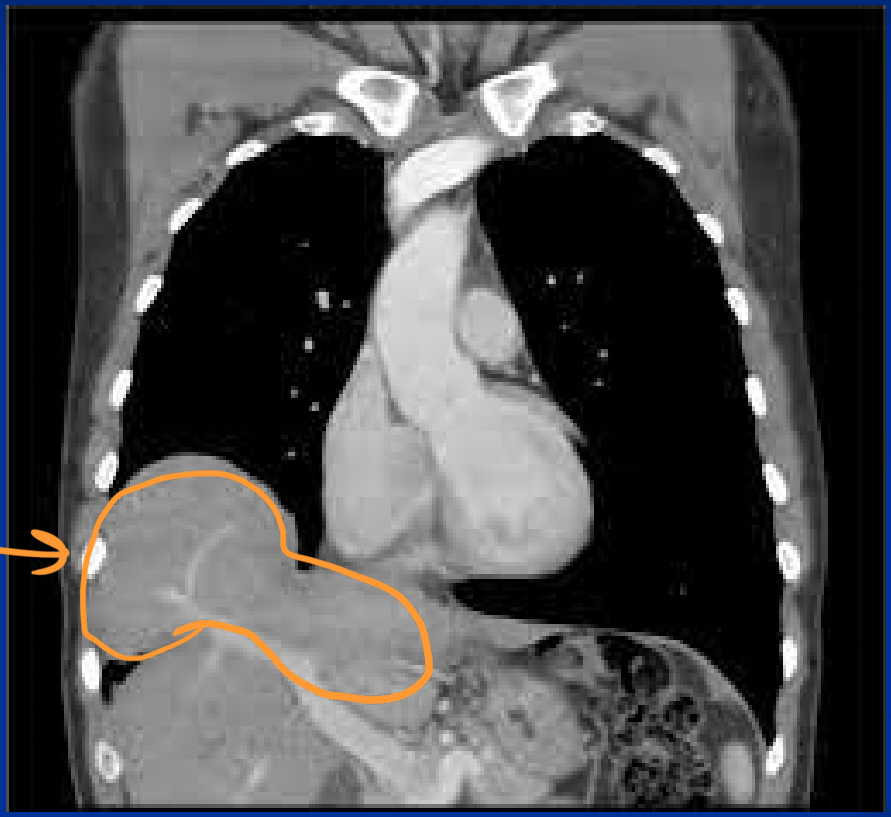
→ bulge

→ diaphragmatic bulge

كيف نميز diaphragmatic rupture عن الـ diaphragmatic hernia ؟

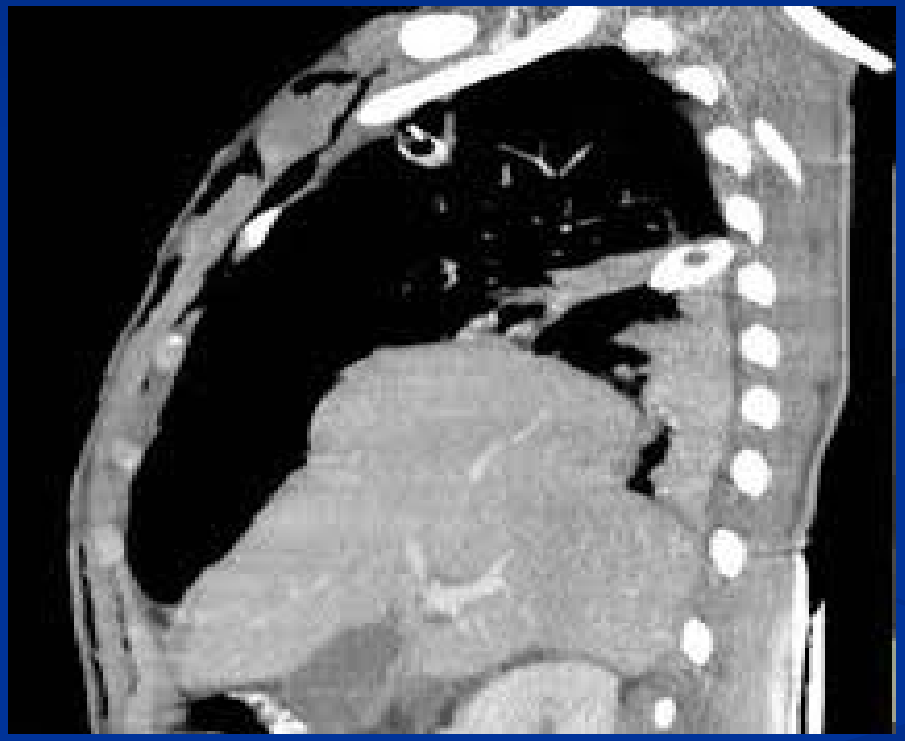
بالهيستوري

Diaphragmatic rupture

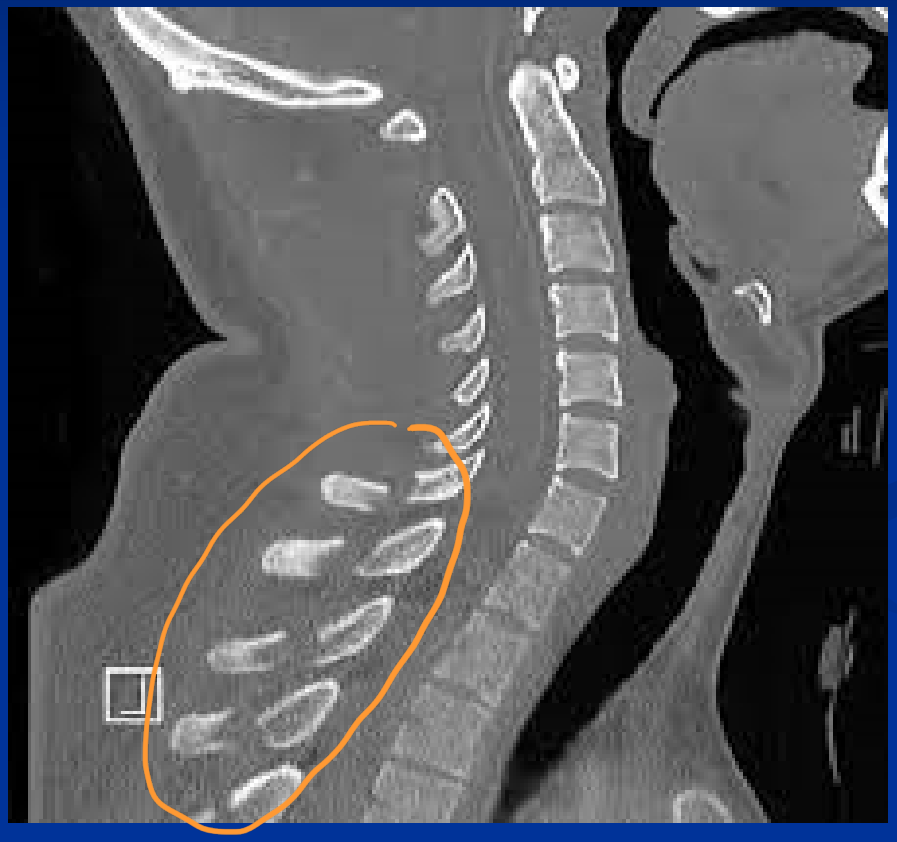


abdominal CT with contrast

Sagittal chest CT



- hourglass sign
- Diaphragmatic rupture



Sagittal cervical spine CT scan

- multiple spinous process fractures

- CT, bone window
  Vertebra (can't know which)
  axial cut

- Transevers Process fracture

- Plain abdominal X-ray showing multiple air-fluid levels, centrally located → obstruction

DDx: adhesions
hernia
mass

- hand X-ray
- two fractures in the diaphysis of ulna and radius

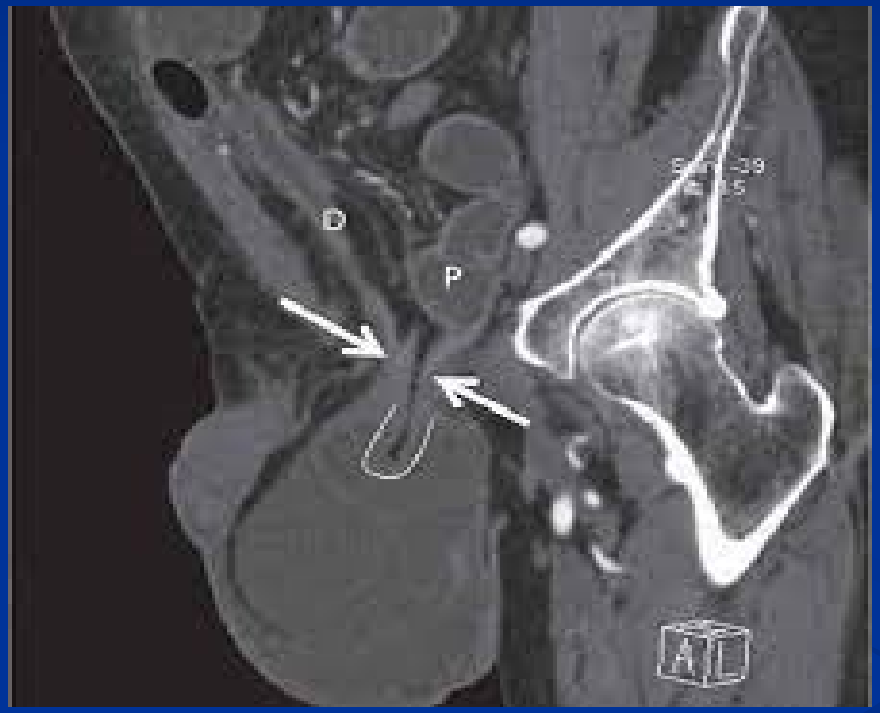
→ greenstick fracture


R
1/1
2/3
20
21
EN
0x

abdominal CT scan with contrast

showing a bulge in mid abdominal wall

narrow nick and the content is bowel



Sagittal Pelvic CT scan with contrast

→ inguinal hernia into the scrotum
↳ bowel content

abdominal CT scan

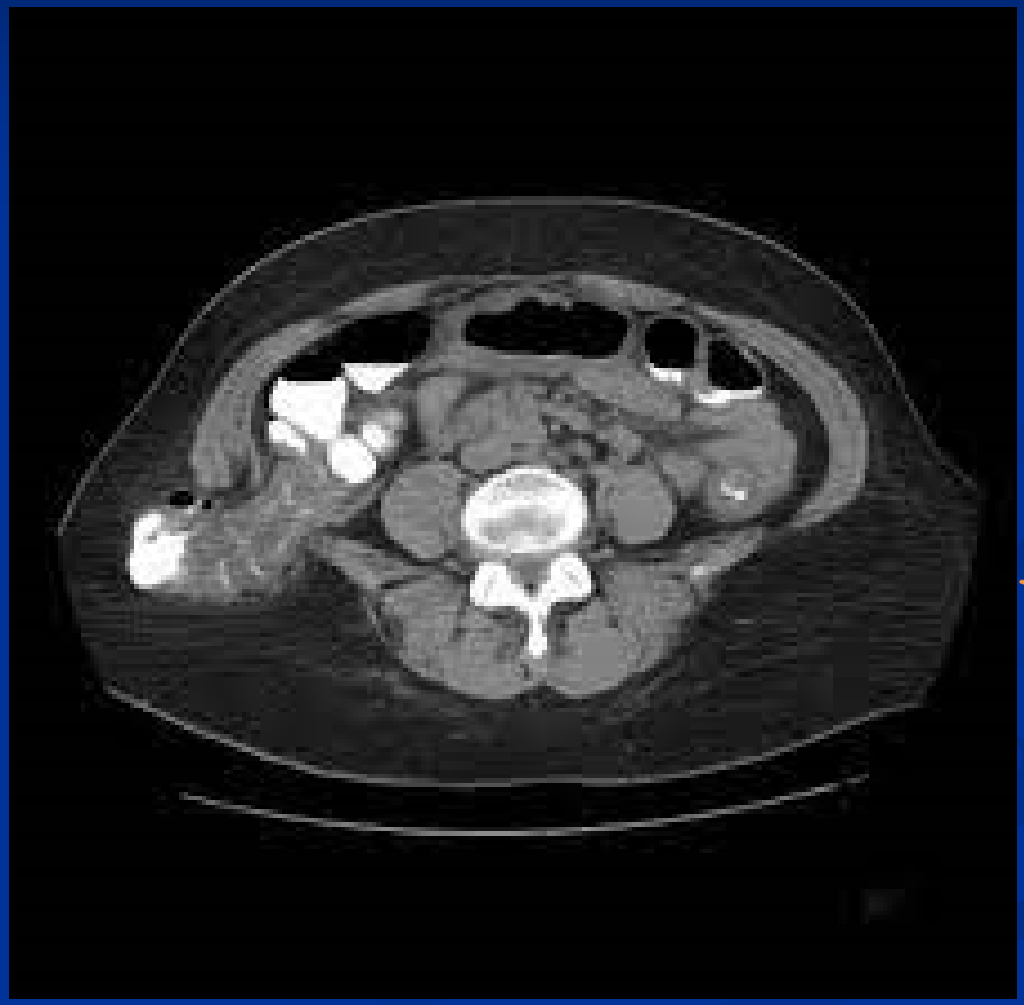
lateral abdominal wall hernia (Spigelian hernia)

abdominal wall defect

wide nick, bowel content

fat content

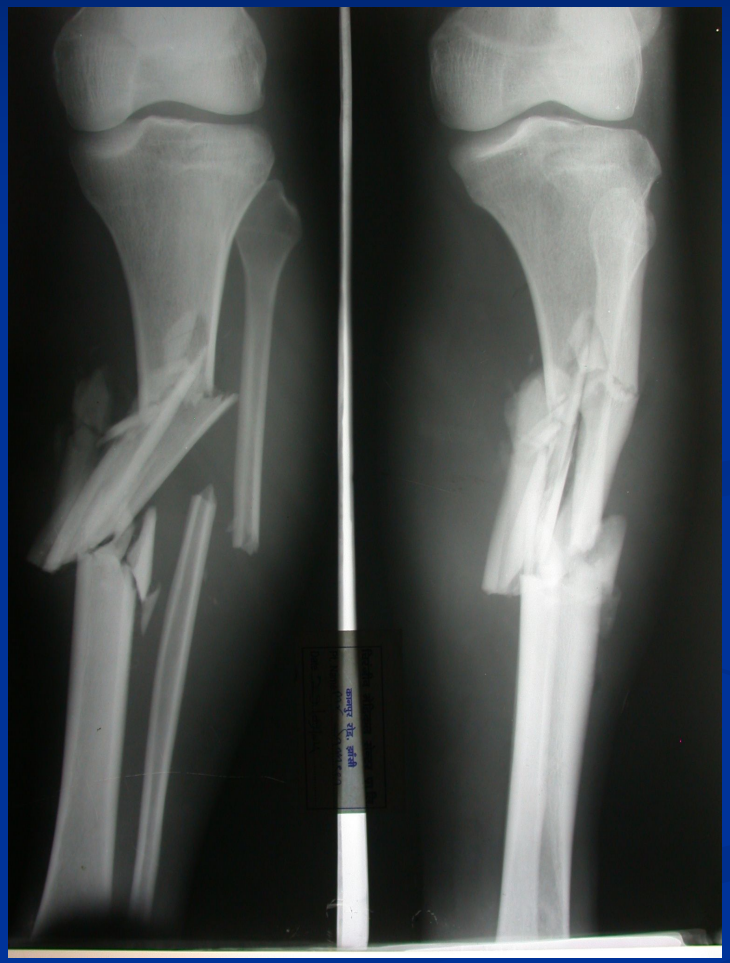
- lumbar hernia



axial abdominal CT scan with oral contrast

- abdominal wall defect on the right side

→ bowel content



lower
- leg x-ray
- displaced linear fracture in fibula
- comminuted fracture in mid-shaft of Tibia


avulsion fracture of medial malleolus