

جَائِزَةُ الْحُسَيْنِ
بْنِ عَبْدِ اللَّهِ الثَّانِي
لِلْعَمَلِ التَّطَوُّعِيِّ

AL HUSSEIN BIN ABDULLAH II
AWARD FOR VOLUNTARY WORK



النادي الطبي
Medical Club



Radiology

Subject: Abdominal X-Ray

Group no: D11

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هَذَا خُلِقَ اللَّهُ فَأَرْوِيهِ مَاذَا خُلِقَ الذِّينَ مِنْ دُونِهِ بَلِ الظَّالِمُونَ فِي ضَلَالٍ مُبِينٍ

The Abdominal X-Ray



Abdominal X-Ray Projections:

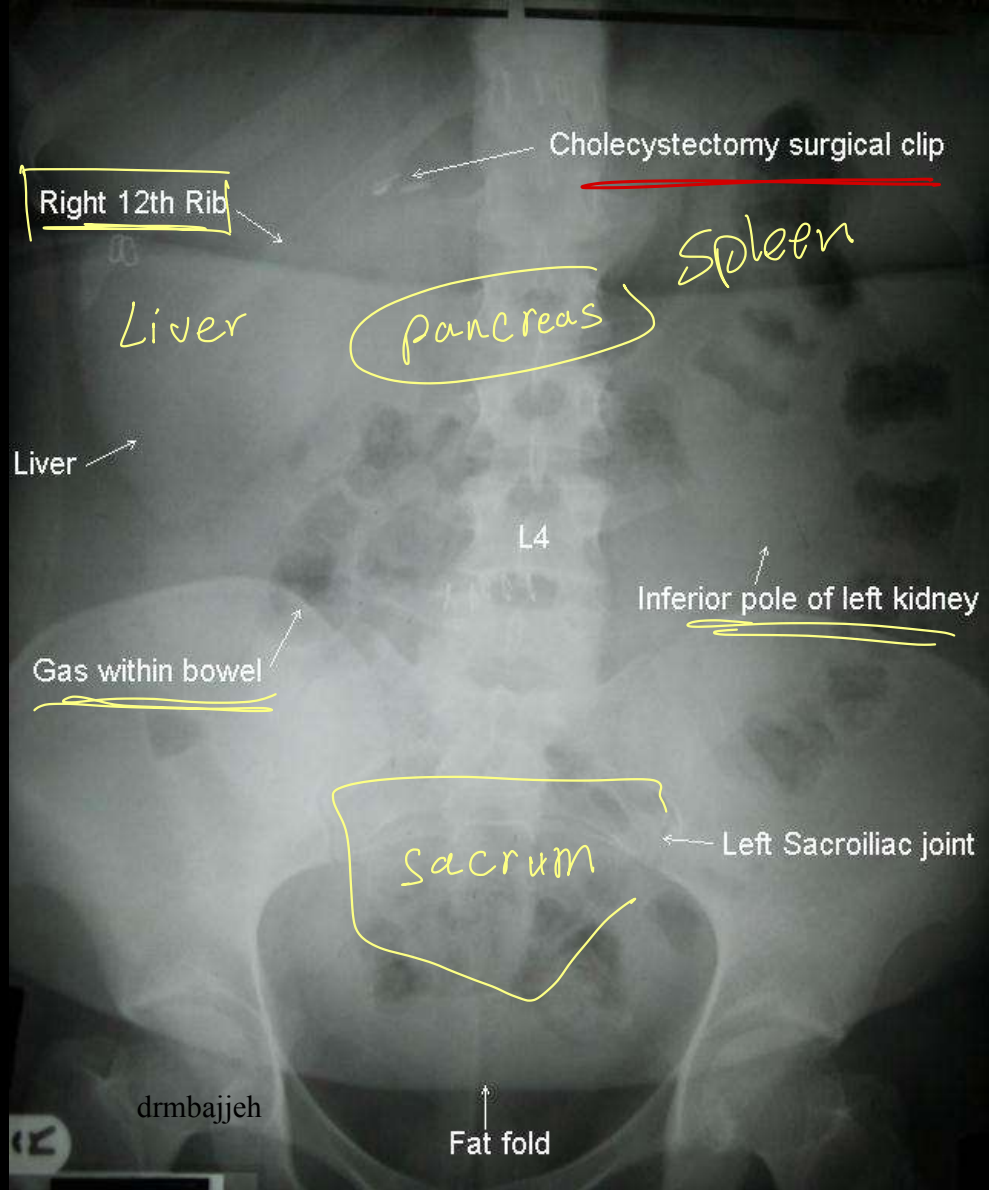
- ✓ • Supine 99% (أكثر استخداماً) , most common use
- ✓ • Erect (fluid levels)
- ✓ • Lateral decubitus. at left side
usually

Knowledge of the anatomy of the abdomen allows localization of the abnormalities observed on the AXR.

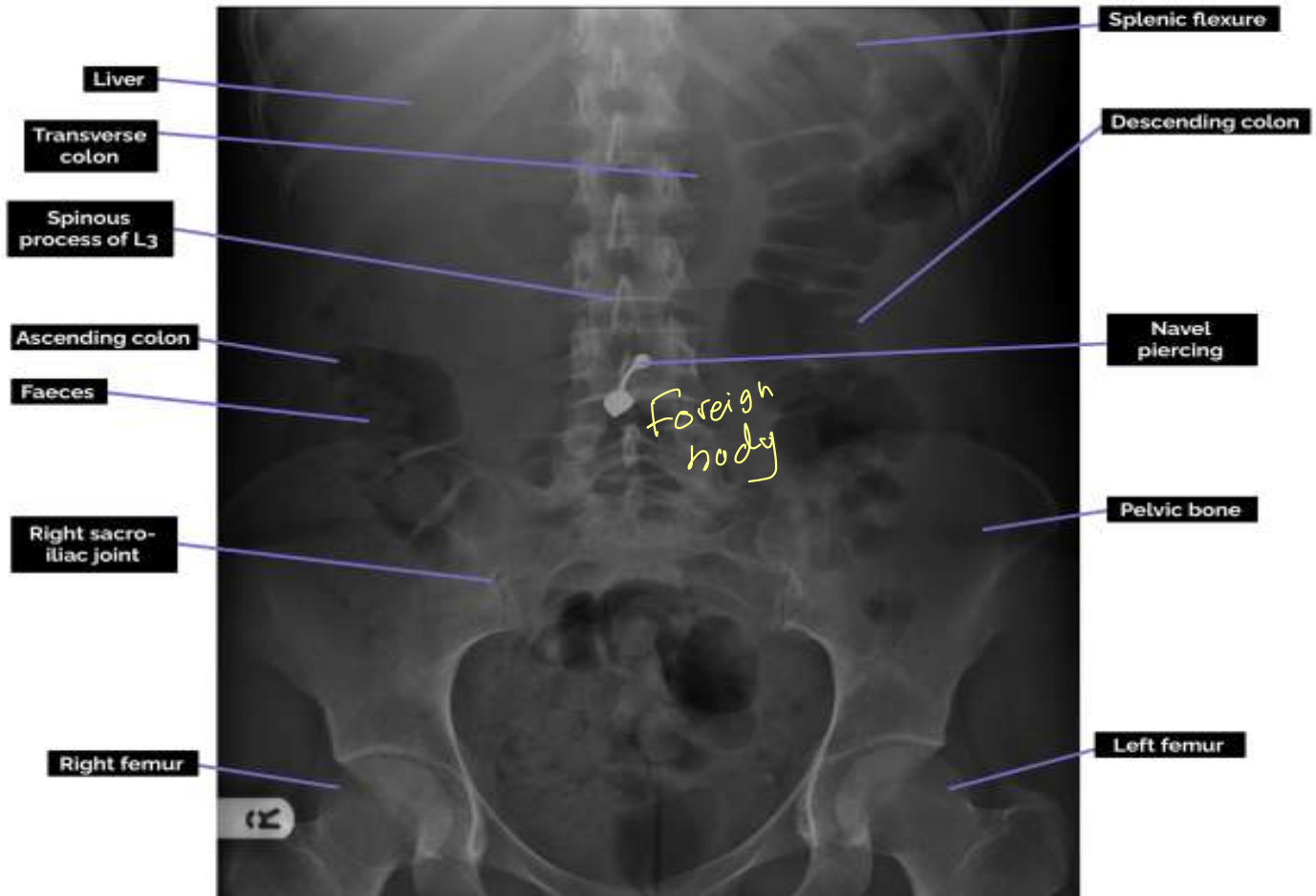
<u>Density</u>	<u>Substance/Structure</u>	
Black	<u>Gas / Air</u>	✓
Dark grey	<u>Fat</u>	✓
Light grey	<u>Soft tissue</u> <u>Fluid</u>	✓
"White"	<u>Bone</u> <u>Calcifications</u>	✓
Intense white	<u>Metal</u>	✓

usually US and x-ray then CT.

Anatomy on the Abdominal X-Ray:

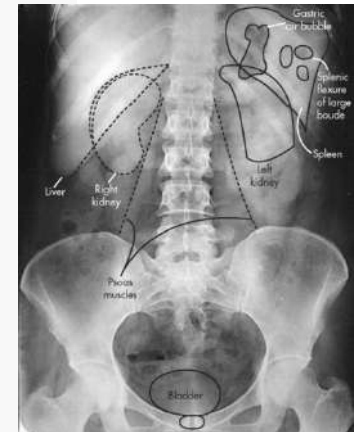


Normal Abdominal X-ray



NORMAL ABD XRAY

1. 11th Rib ✓
2. Vertebral body (T 12) ✓
3. Gas in stomach ✓
4. Gas in colon (splenic flexure)
5. Gas in transverse colon
6. Gas in sigmoid
7. Sacrum
8. Sacroiliac joint
9. Femoral head
10. Gas in cecum
11. Iliac crest
12. Gas in colon (Hepatic flexure)
13. Psoas muscle

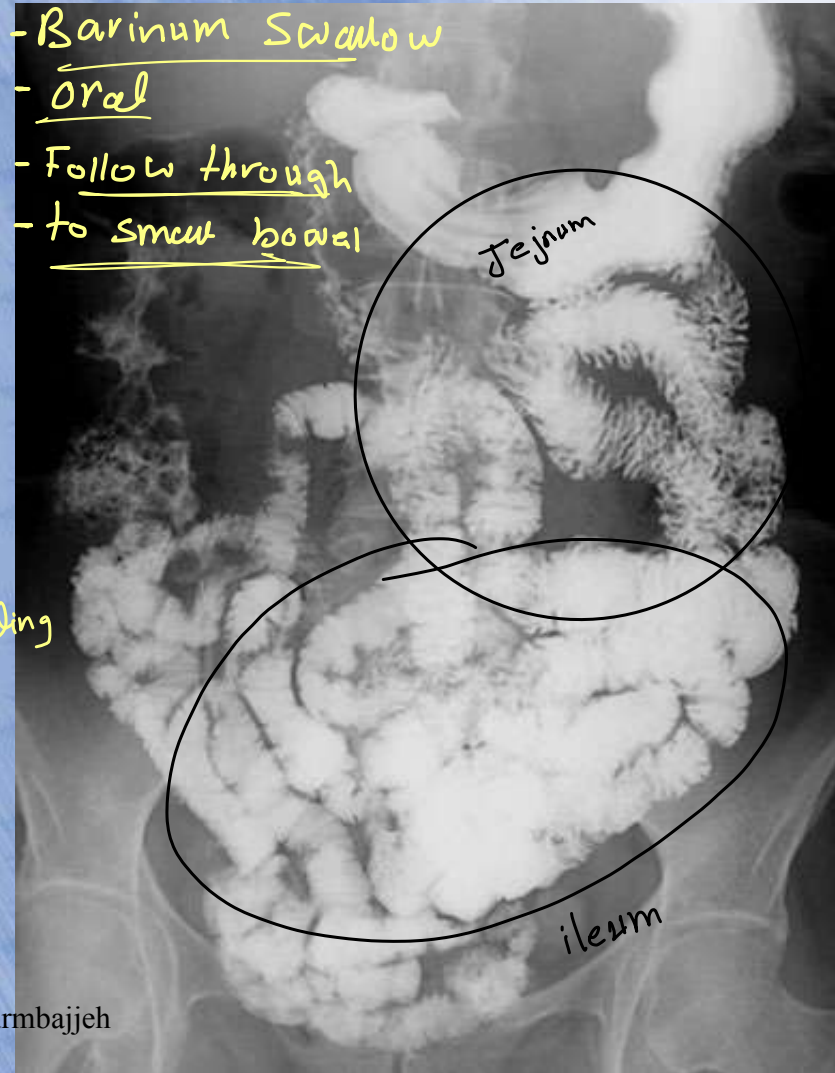
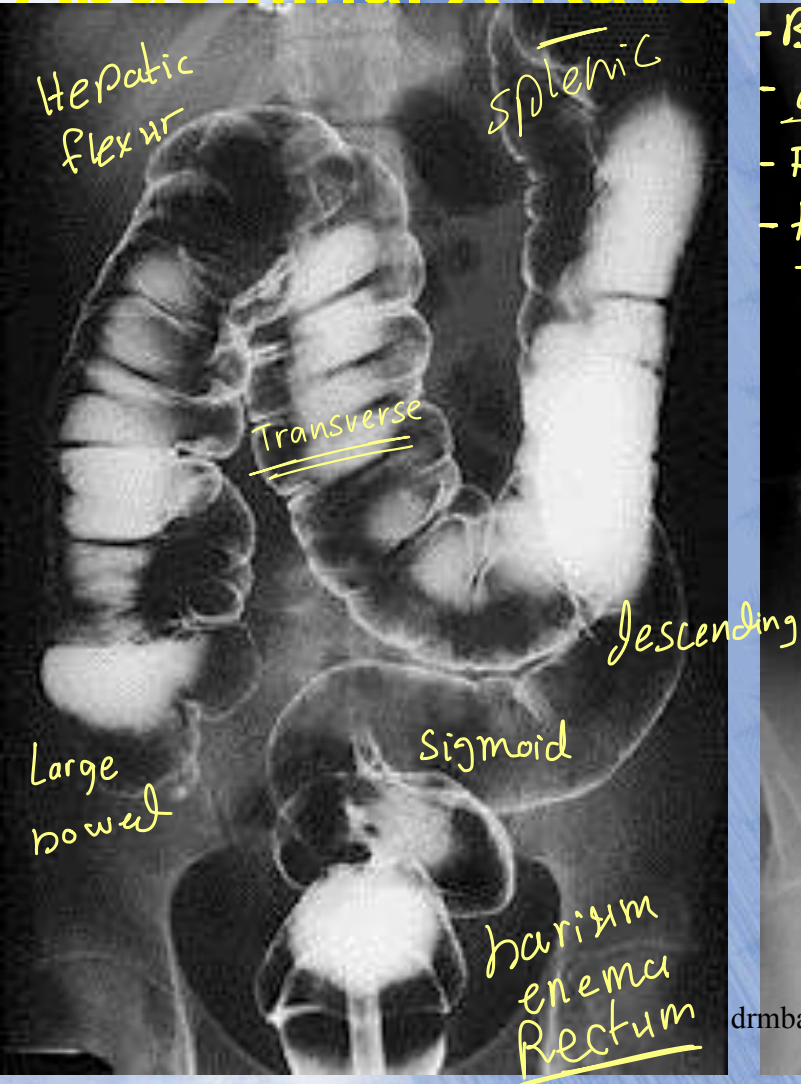


Abdominal X-Ravs:

CT → coronal cut



Abdominal X-Rays:



Film Specifics and Technical Factors:

The initial assessment of an AXR is the same as for a CXR:

Film Specifics:

- Name of Patient ✓
- Age & Date of Birth ✓
- Location of Patient ✓
- Date Taken ✓
- Film Number (if applicable) ✓



Film Technical factors:

- Type of projection (Supine is standard)
- Markings of any special techniques used

Assess the Film in Detail:

APPROACH TO ABDOMINAL XRAY

- 1 • Bowel gas pattern
- 2 • Calcifications
- 3 • Extra-luminal air
- 4 • Soft tissue masses

‘BLACK BITS’

- Intra-luminal gas can be normal.
- Extra-luminal gas is abnormal.
- However, intra-luminal gas can be abnormal if it is in the wrong place or if too much is seen.

Assess the Film in Detail:

3, 6, 9 cm
↓ ↓ ↓
Small Large Cecum

‘BLACK BITS’ (Continued) - Intra-luminal gas:

- The maximum normal diameter of the large bowel is 55mm. $cm \times 10 = in \text{ mm}$

- Small bowel should be no more than 35mm in diameter.

- The natural presence of gas within the bowel allows assessment of caliber - although the amount varies between individuals.

- The caecum is not said to be dilated unless wider than 80mm.

- Large and small bowel may be distinguished by looking at bowel wall markings, as shown in the box below.

Assess the Film in Detail:

The haustra of the large bowel extend only a third of the way across the bowel from each side, whereas the valvulae conniventes of the small bowel tranverse the complete distance.

Intra-luminal gas (continued):

It is usual to see small volumes of gas throughout the GI tract and the absence in one region may in itself represent pathology.

For example, if gas is seen to the level of the splenic flexure and nothing is seen beyond this, a site of the obstruction at this site – a ‘cut off’ point is noted.

Assess the Film in Detail: Abdominal X-ray

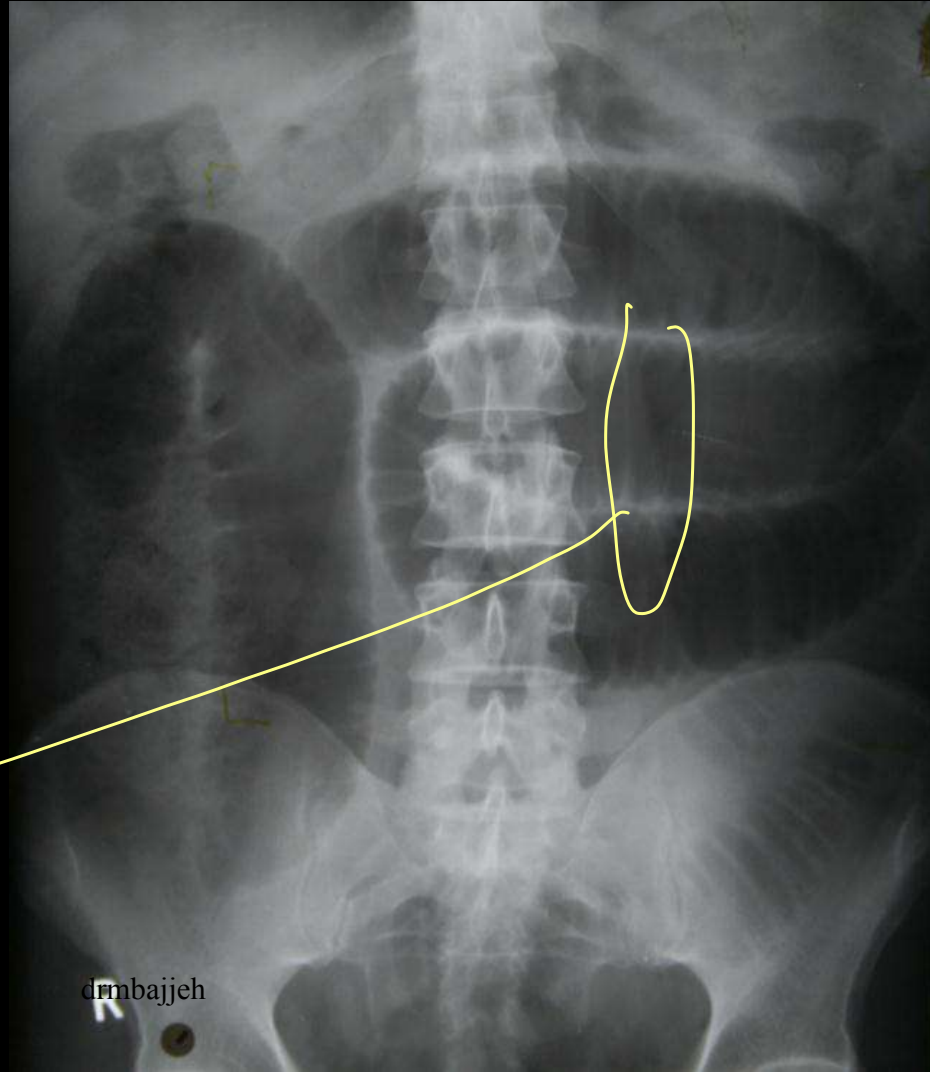
Intra-luminal Gas:

Low Small Bowel ✓

Obstruction ✓

- Small
central

Scalogram



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Sigmoid Volvulus

Findings include:

- ✓ Massively dilated colon
- ✓ Haustra usually absent
- ✓ "Coffee bean" sign



Large ✓
bowel

Sigmoid
volvulus





liegend

large
bowel

L

Assess the Film in Detail:

If bowel obstruction is observed try to look for the cause. For example a hernia as the cause of obstruction.

إلى جدار البطن
من الحوض.

Hernia.



Anatomy – Bowel Gas

Small Bowel	Large Bowel
Usually located centrally	Usually located peripherally
Mucosal folds (a.k.a. valvulae conniventes, Kerckring folds) are relatively thin and span the width of the bowel	Mucosal folds (haustra) are relatively thick, and <i>usually</i> do not span the width of the bowel
Upper limit of normal for diameter: 3cm	ULN for diameter ▪ Colon: 6cm ▪ Cecum: 9cm

The “3-6-9 rule”



Large
Bowel

Small
Bowel

Small Bowel Obstruction



Supine



Upright

Small Bowel Obstruction

"String of pearls" sign



Upright

Thumbprinting

- Thumb-shaped indentations in the bowel wall caused by edema of haustra related to infection/inflammation

- Etiologies include:

- Inflammatory bowel disease ✓
- Infectious colitis (e.g. C. diff) ✓
- Diverticulitis ✓
- Ischemic colitis ✓



Constipation

Findings include:

Soft tissue-like opacities with internal mottled air within the large bowel



Cecal Volvulus

Findings include:

- Massively dilated colon
- Haustra usually present
- Lack of colon in RLQ



Sigmoid Volvulus

Findings include:

- Massively dilated colon
- Haustra usually absent
- "Coffee bean" sign



Cecal vs. Sigmoid Volvulus



Sigmoid

most common



Cecal

less common

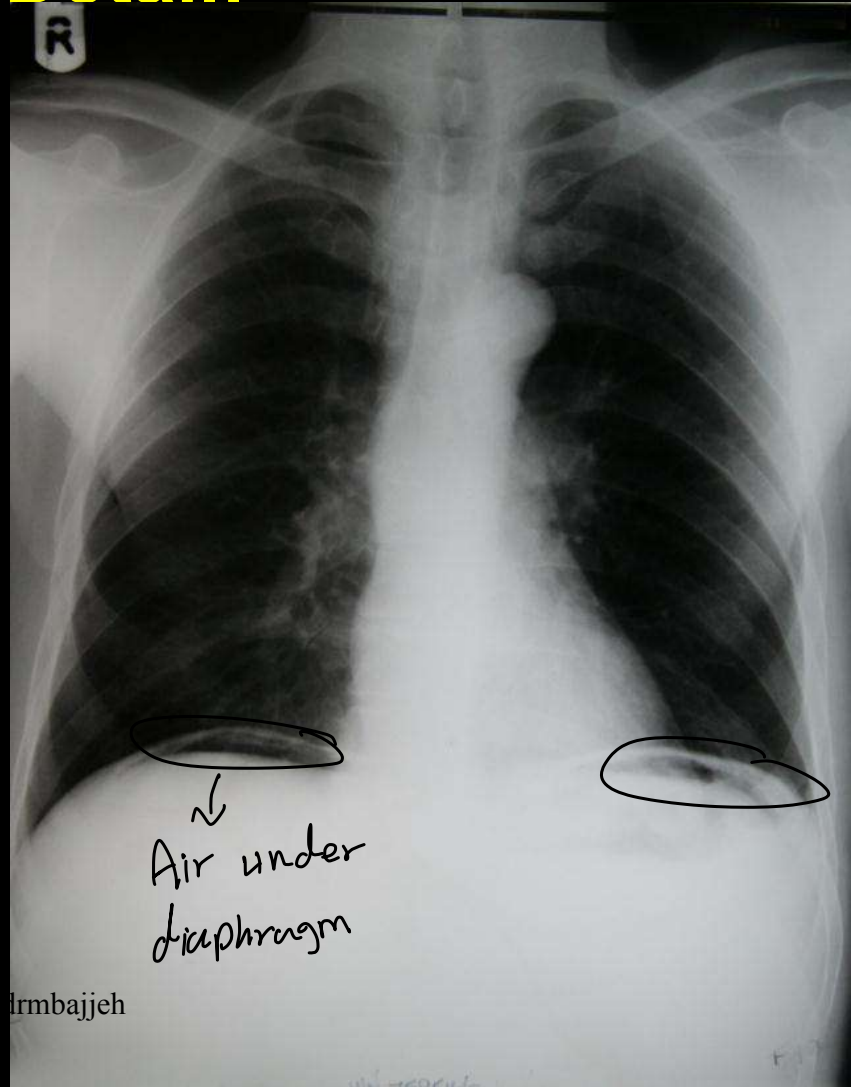
Assess the Film in Detail:

Extra-luminal Gas:

When an bowel is obstructed, or any other gas containing structure perforates, its contained gas becomes **extra-luminal**.

Extra-luminal gas is **never normal**, but may be seen following **intra-abdominal surgery** or **endoscopic retrograde cholangiopancreatography (ERCP)**.

Extra-luminal gas seen on **erect CXR**.



Assess the Film in Detail:

Causes of Extra-luminal gas:

- **Post Abdominal Surgery/ERCP** *Most common cause*
- **Perforation of viscus (eg. bowel, stomach)** *From DU.*
- **Gallstone ileus** *تنقبذ ال GB بعين لا duodenum ← توجل ال . ileum*
- **Cholangitis (infection with gas forming organisms)**
- **Abscess** *From Fermentation*

An erect CXR (not AXR) is the best projection to diagnose a pneumoperitoneum (gas in the peritoneal cavity). ✱

Pneumoperitoneum



Upright chest

Etiologies include:

- Peptic ulcer disease
- Bowel ischemia (any cause)
- Appendicitis
- Colitis
- Diverticulitis
- Penetrating abdominal trauma
- Foreign body ingestion
- Endoscopic complication
- Immediately post-surgery (normal)

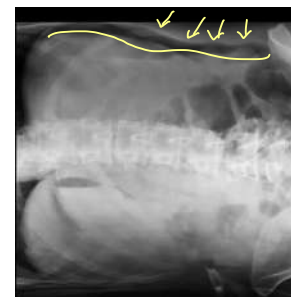
Pneumoperitoneum



Upright chest



Left lateral decubitus



Left lateral decubitus

Assess the Film in Detail:

• **‘WHITE BITS’ = Calcification**

Calcified structures (‘WHITE BITS’) are often seen on AXR.

The main question is – does its presence have any important implications. Calcification can be broadly divided into 3 types:

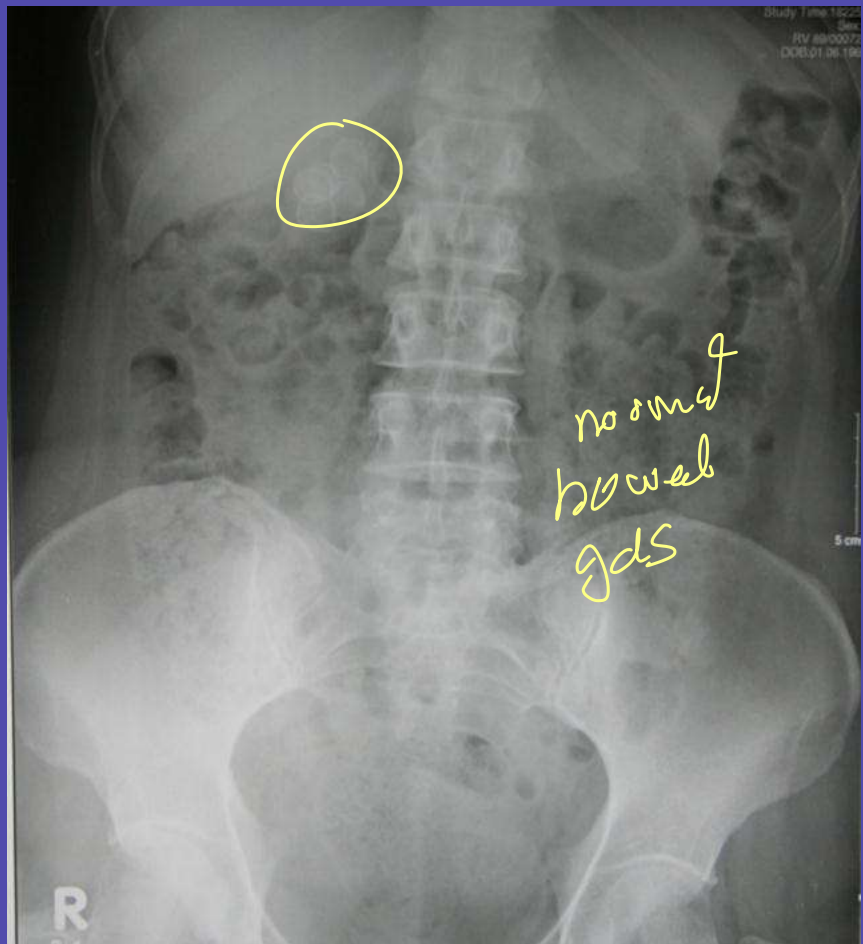
- (1) Calcium that is an ^{*}abnormal structure - eg. gallstones and renal calculi
- (2) Calcium that is within a normal structure^{*}, but represents pathology.
- eg. nephrocalcinosis,
- (3) Calcium that is within a normal structure, but is harmless - eg. lymph node calcification.

Bones are normal ‘white’ structures. On the AXR they comprise mainly those of the thoraco-lumbar spine and pelvis. Findings are largely incidental as direct bone pathology would be investigated with specific views.

Assess the Film in Detail:



Pancreatic Calcification



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Gallstones

Nephrolithiasis

- Majority of kidney stones are radiopaque (contain calcium)
- Can be present in the:
 - Renal pelvis ✓
 - Ureter ✓
 - Bladder ✓
 - Urethra ✓



Staghorn calculus

Definition

A large renal stone that occupies the renal pelvis and extends into multiple calyces, forming a shape like deer antlers (staghorn).

Composition ★

- Most commonly struvite (Magnesium ammonium phosphate)
- Associated with chronic UTI by urease-producing bacteria
[Proteus] Klebsiella, Pseudomonas

Gallstones

- Only a minority of gallstones are radiopaque. (i.e. seen on X-ray)
- Can be present in the:
 - Gallbladder ✓
 - Cystic duct ✓
 - Common bile duct ✓
 - Bowel ✓



Pancreatic Calcifications

Etiologies include:

- Chronic pancreatitis ✓
- Cystic fibrosis ✓
- Pancreatic cancer ✓
- Senile (a.k.a. senescent) ✓



Assess the Film in Detail:

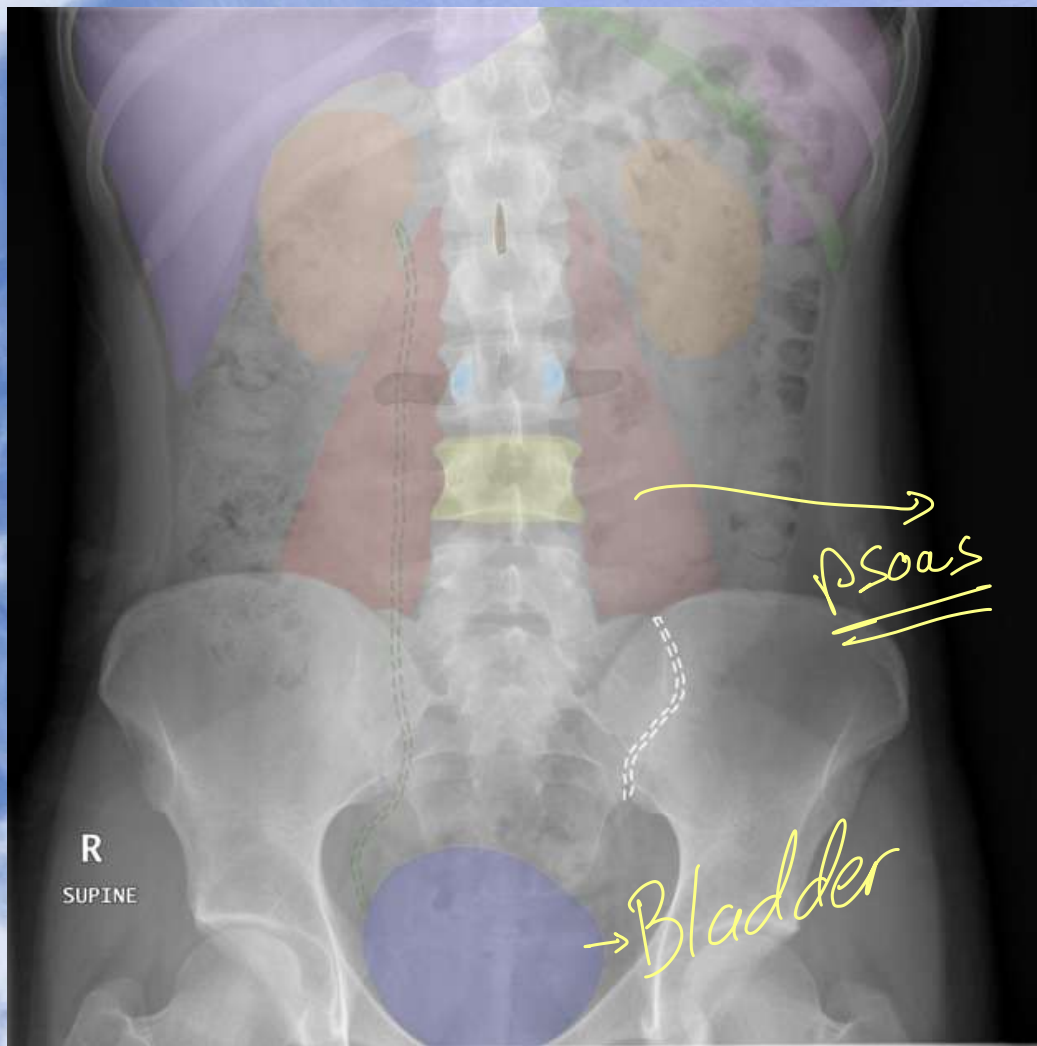
‘GREY BITS’ = Soft Tissues

Soft tissues represent most of the contents of the abdomen and feature heavily in the AXR. However, these tissues are poorly seen when compared to other imaging techniques such as ultrasound or CT.

The kidneys, spleen, liver and bladder (if filled) can be seen in addition to psoas muscle shadows and abdominal fat. Rarely would action be taken on the basis of this imaging alone.



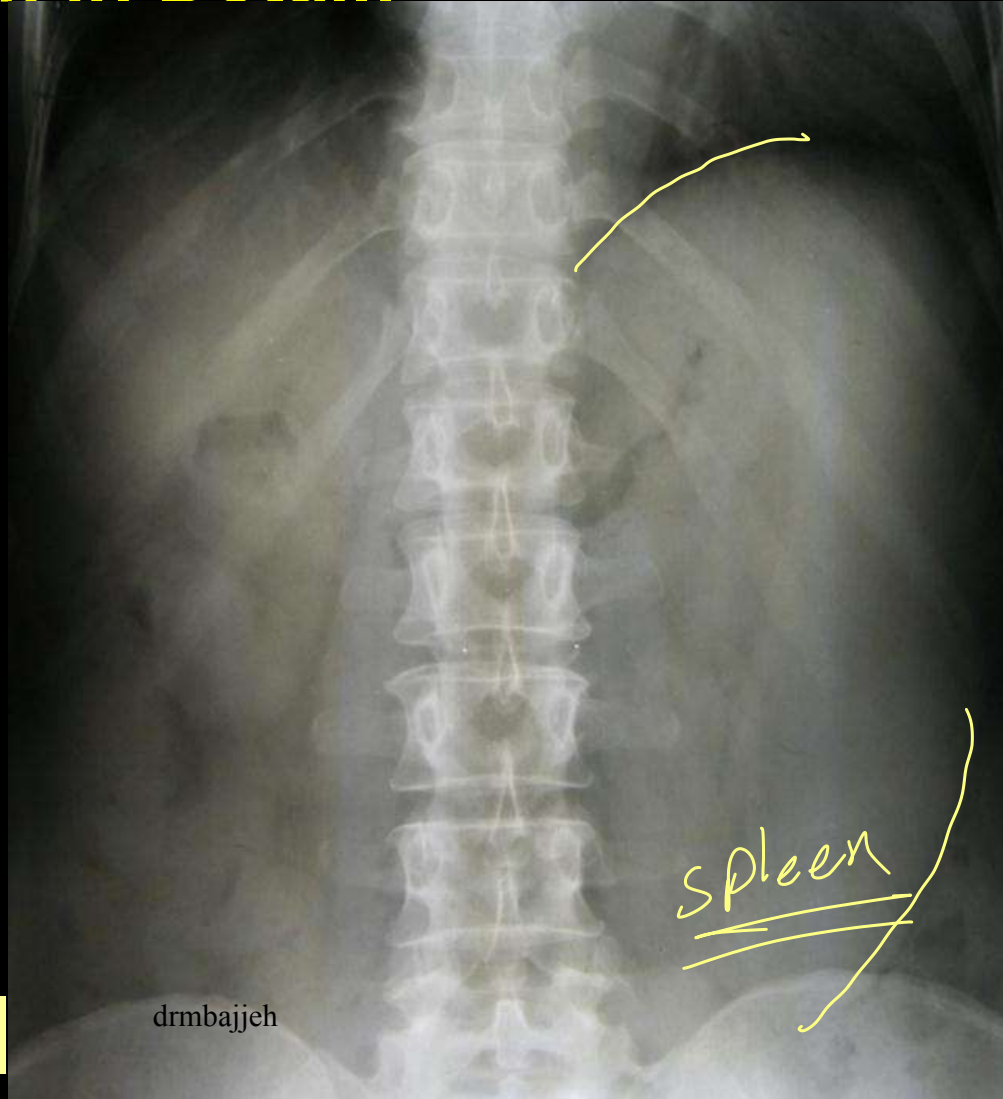
antropojet



Assess the Film in Detail:

post And x-ray

Splenomegaly



Assess the Film in Detail:

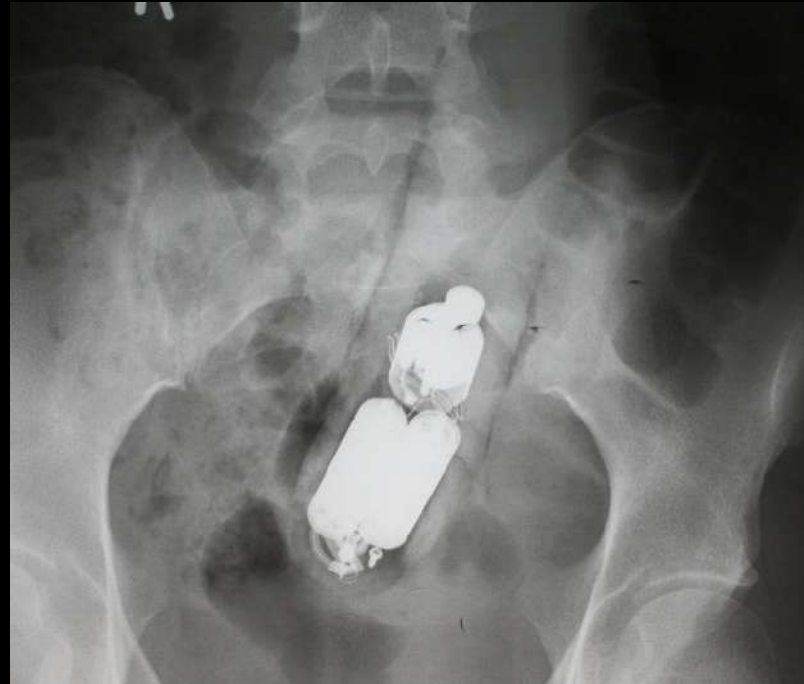
‘BRIGHT WHITE BITS’ = Foreign Bodies

Foreign Bodies represent an interesting final observation. Objects that may be seen include ingested and rectal foreign bodies, items in the path of the x-ray beam such as belt buckles, dress buttons and jewelry. Other objects may have been deliberately placed for example an aortic stent, an inferior vena cava filter or a suprapubic urinary catheter. Sterilization clips and an intra-uterine device are common findings in women.

Assess the Film in Detail:

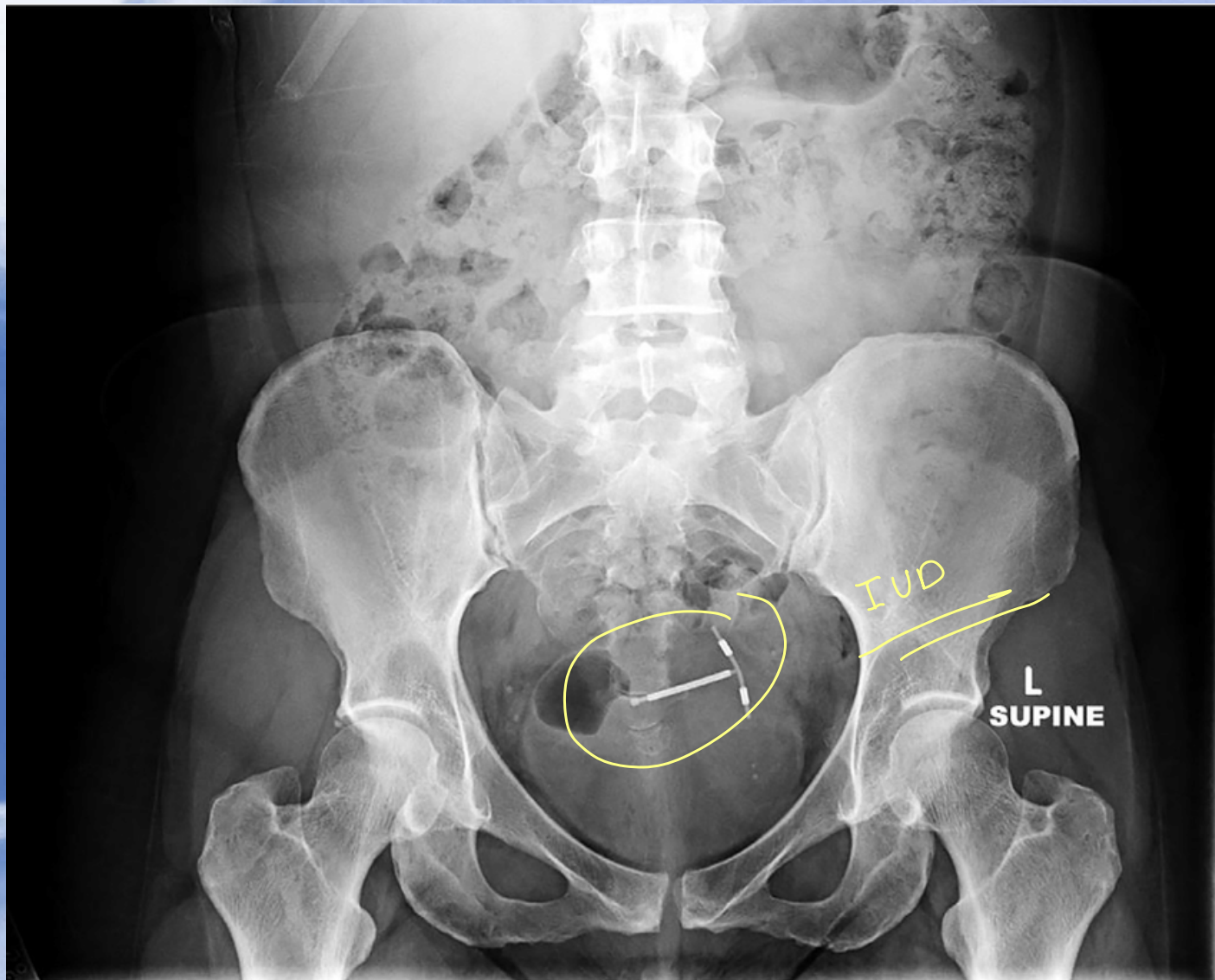


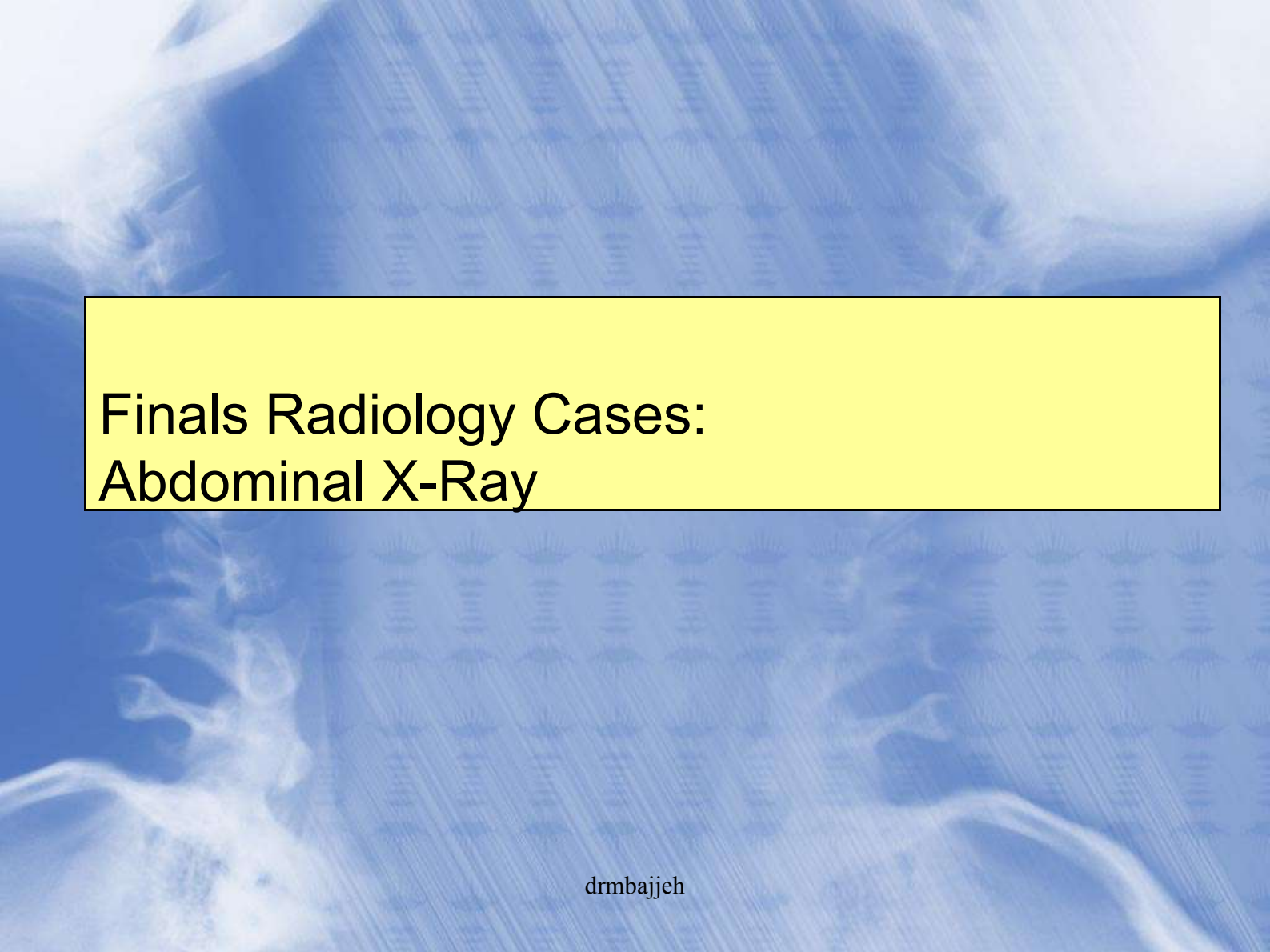
Surgical Clips



Foreign body per rectum







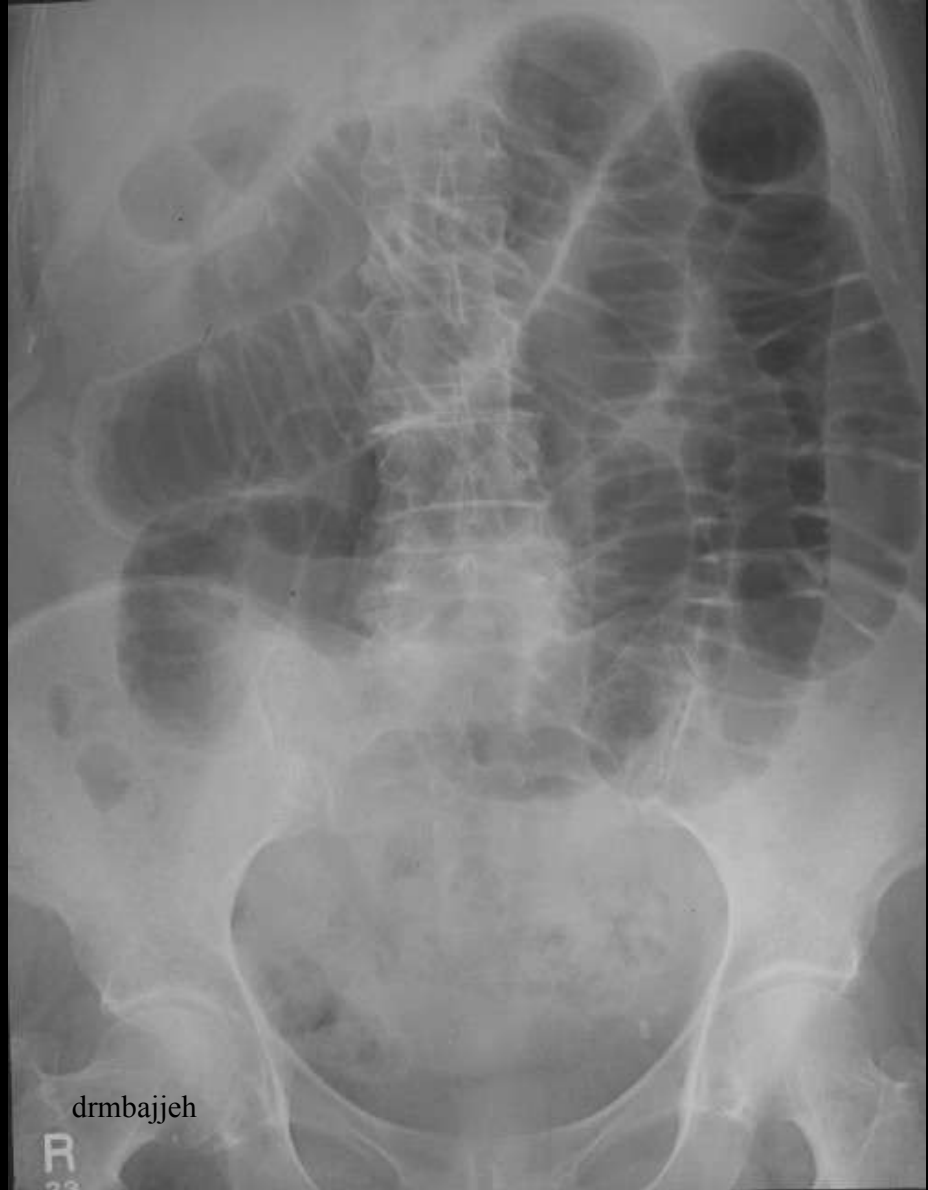
Finals Radiology Cases: Abdominal X-Ray

Case 1:

This 67 year-old woman presented to the surgical ward with a distended abdomen and vomiting.

Present this x-ray

Give a diagnosis and potential causes



Case 1: Answer

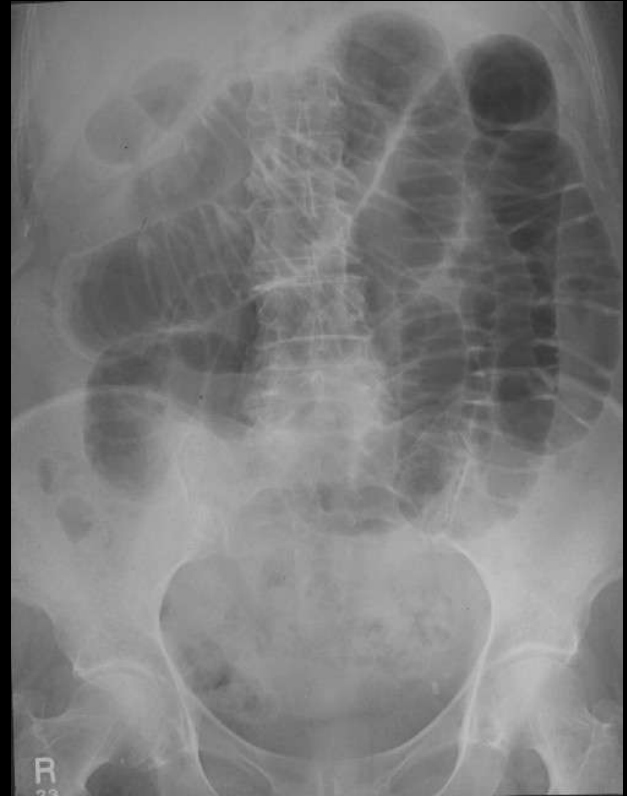
Radiology Report:

Plain abdominal radiograph.

Multiple dilated loops of small bowel within the central abdomen. Gas is not seen in the large bowel. No evidence of hernia or gallstone to suggest potential cause of the dilated loops.

These findings are in keep with a small bowel obstruction.

I would like to know if the patient has a history of abdominal surgery as the commonest cause is surgical admissions.



The three commonest causes of small bowel obstruction are:

- Surgical adhesions most common
- Herniae
- Intraluminal mass eg, small bowel lymphoma or gallstone (in gallstone ileus)

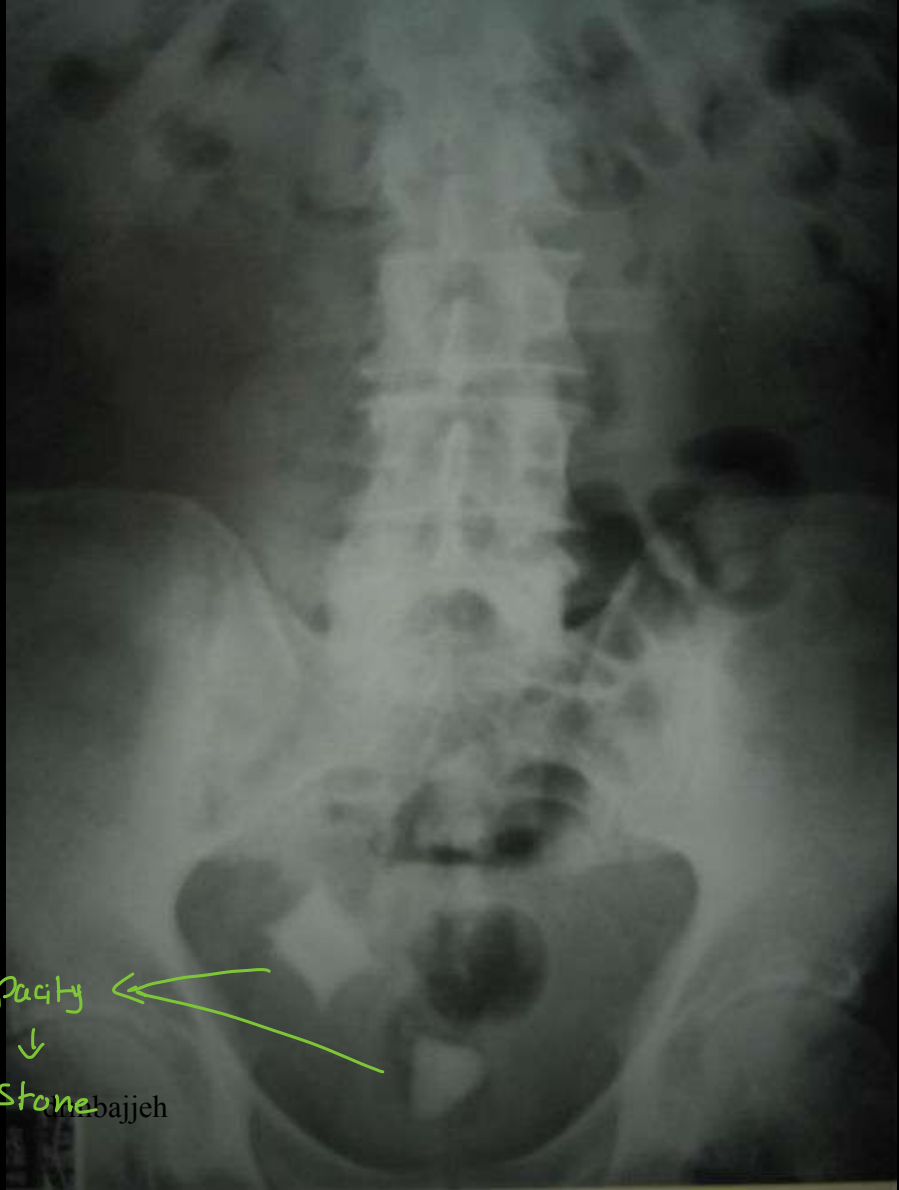
Case 2:

This 71 year-old gentleman visits his GP complaining of blood in his urine. He has had a number of UTI's in recent years.

Present this x-ray

Give a diagnosis and potential causes

opacity
↓
stone



Case 2: Answer

Radiology Report:

Plain abdominal radiograph.

Two rounded radio-opacities measuring 4cm within the pelvis. Both opacities are smooth in outline, laminated in nature, have the same density as bone and project over the bladder. No other renal tract calcification.

Does the patient have a history of neurogenic bladder?

Given the size of these stones and history of UTI's these are bladder calculi.



Bladder calculi are more common in those with a history of:

- UTI's
- A neurogenic bladder
- Bladder diverticulum

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Jackstone calculus (Jackstone stone)

هو نوع نادر من حصي المثانة يتميز بشكل نجمي أو يشبه لعبة الجيك (Jackstone) وله زوائد حادة بارزة.

بـ كـ بـ الـ Stones

مميزاته:

- يوجد غالبا في المثانة البولية (أكثر من الكلى).
- يتكون عادة من Calcium oxalate dihydrate
- شكله نجمي ذو أطراف حادة ♡ قد يسبب تهيجا شديدا لجدار المثانة.

Case 3:

This patient was admitted with poor renal function.

Present this x-ray

Give a diagnosis and potential causes



Case 3: Answer

Radiology Report:

Plain abdominal radiograph

Multiple areas of punctuate calcification project over the renal outlines bilaterally.

The calcifications within the medulla of the renal parenchyma. The bones are normal in appearance.

These findings are consistent with nephrocalcinosis



Causes of Nephrocalcinosis include:

- Hyperparathyroidism
- Medullary sponge kidney

Definition
A congenital benign disorder characterized by cystic dilatation of the collecting ducts in the renal medulla.
Why it matters
• Urinary stasis in dilated ducts → stones + UTIs
• Strongly associated with medullary nephrocalcinosis

* if stones in pelvic → Renal stone