



PIPADOR REVISION

MRCOG Part 1 Revision Notes

X-Ray of the Abdomen and Pelvis

IMAGING • LECTURE 38

VISUAL EXAMINATION REVISION NOTES

2026 Edition

MRCOG Part 1 Revision Notes

Lecture 38: X-Ray of the Abdomen and Pelvis

Imaging • Visual revision edition

COLOUR CODE USED THROUGHOUT THESE NOTES

PHYSICS	RADIATION SAFETY	ABDOMINAL FILM	GYNAE (HSG, IUCD)	ALTERNATIVES
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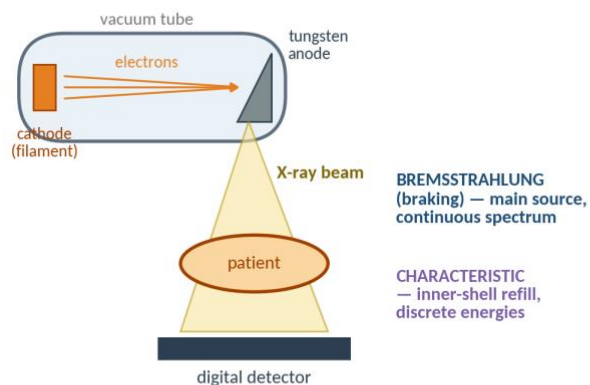
LEARNING OBJECTIVES — tick off as you go

- ☐ Explain how X-rays are produced and how the image forms.
- ☐ Know typical doses and the principles of radiation protection, including in pregnancy.
- ☐ Read an abdominal film systematically; recognise obstruction and perforation.
- ☐ Identify pelvic calcifications and a displaced IUCD.
- ☐ Describe the technique, findings and complications of hysterosalpingography.

1 Physical Principles

IN ONE LINE: Electrons hit a tungsten anode → X-rays; tissues absorb them to different degrees → a shadow picture on the detector.

Making an X-ray



The five radiographic densities

	GAS black — bowel, lungs
	FAT dark grey — around organs
	SOFT TISSUE / WATER mid grey — organs, muscle, bladder
	BONE / CALCIUM white
	METAL brightest — clips, IUCD, prosthesis

Attenuation rises with **DENSITY**, **ATOMIC NUMBER** (calcium, iodine, barium) and **THICKNESS**.

Figure 1. Making an X-ray, and the five densities.

2 Radiation Safety

How much radiation?

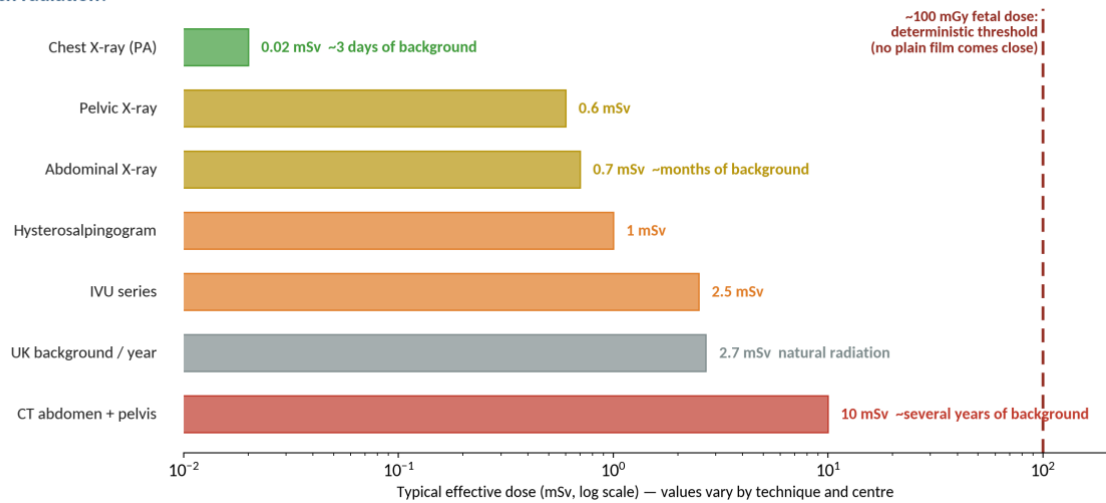


Figure 2. Typical effective doses.

PRINCIPLES (IR(ME)R 2017)

- **Justification** — benefit outweighs risk
- **Optimisation** — ALARA: collimation, filtration, fewest films
- **Dose limits** — for staff and public (not patients)

WOMEN OF REPRODUCTIVE AGE

- Ask about pregnancy before any abdominal/pelvic exposure
- **28-day rule** for most examinations — go ahead if pregnancy is unlikely
- **10-day rule** kept for higher-dose pelvic procedures in some protocols (first 10 days of the cycle)

Fetal radiation risk by gestation (weeks after conception)



A single diagnostic abdominal or pelvic film is far below these thresholds — it is never a reason to end a pregnancy. Use ultrasound or MRI where they will do.

Figure 3. Fetal radiation risk by stage.

- Fetal effects are measured as **absorbed dose (mGy)**. Deterministic effects need roughly **100 mGy or more** — no plain film comes close. The stochastic childhood-cancer risk is small (roughly an extra 1 in 1000–2000 per 10 mGy).

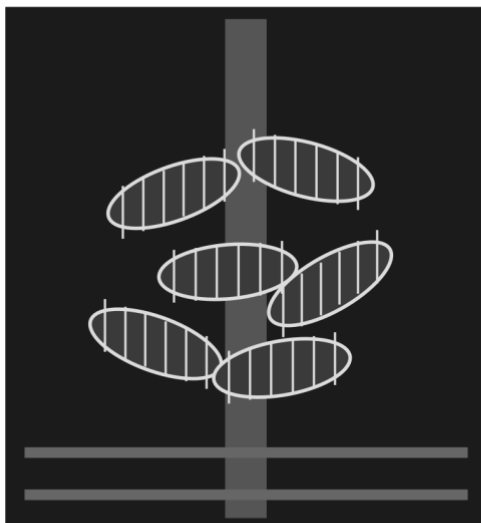
EXAM HOOK

A single diagnostic abdominal or pelvic X-ray **never justifies termination**. In pregnancy use **ultrasound first, then MRI**; CT only when clearly needed.

3 The Abdominal X-Ray

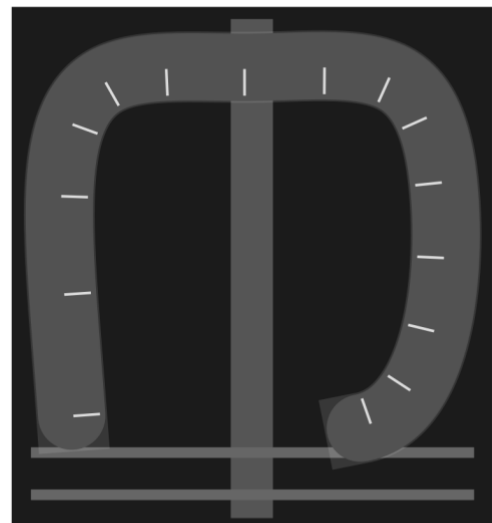
Item	Detail
Indications	Obstruction; perforation (with an erect chest film); toxic megacolon; foreign body; 'lost' IUCD (after excluding pregnancy); renal stones (CT KUB now preferred)
Projection	Supine AP, diaphragm to symphysis
Systematic review	Bowel gas pattern, extraluminal gas, bones, calcification, soft tissues, artefacts/devices

SMALL bowel obstruction



CENTRAL loops > 3 cm • VALVULAE CONNIVENTES cross the full width
• little colonic gas

LARGE bowel obstruction



PERIPHERAL frame > 6 cm (caecum > 9 cm = perforation risk)
• HAUSTRA cross only part of the width

The 3–6–9 rule: small bowel < 3 cm • colon < 6 cm • caecum < 9 cm (schematic supine AXR)

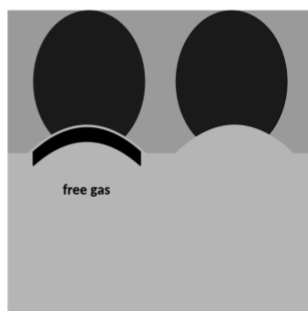
Figure 4. Small vs large bowel obstruction.

MNEMONIC / MEMORY HOOK

3–6–9: small bowel < 3 cm, colon < 6 cm, caecum < 9 cm. Small bowel = central + **valvulae conniventes** (full width); large bowel = peripheral + **haustra** (part width).

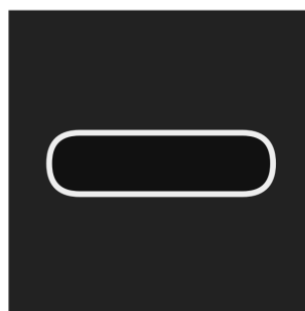
Signs of pneumoperitoneum (schematic)

ERECT CXR — gas under the diaphragm



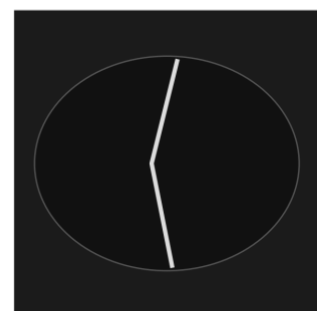
most sensitive plain film
(~1–2 mL); patient upright ~10 min

RIGLER'S (double-wall) sign



gas INSIDE and OUTSIDE the bowel
makes both walls visible (supine)

FOOTBALL sign



massive pneumoperitoneum on a supine film;
falciform ligament outlined as the 'lace'

Figure 5. Signs of free intraperitoneal gas.

- Also: gas outlining the **falciform ligament**, and gas under the central diaphragm (cupola sign). If she can't stand, use a **left lateral decubitus** film.

4 The Pelvic Film and Calcification

- Bones:** iliac crests, sacro-iliac joints, sacrum, coccyx, acetabula, femoral heads, obturator foramina (symmetrical), symphysis (widens in pregnancy). **Soft tissue:** bladder outlined by fat; uterus only if calcified; rectal gas.

Calcification and metal on a pelvic film (schematic)

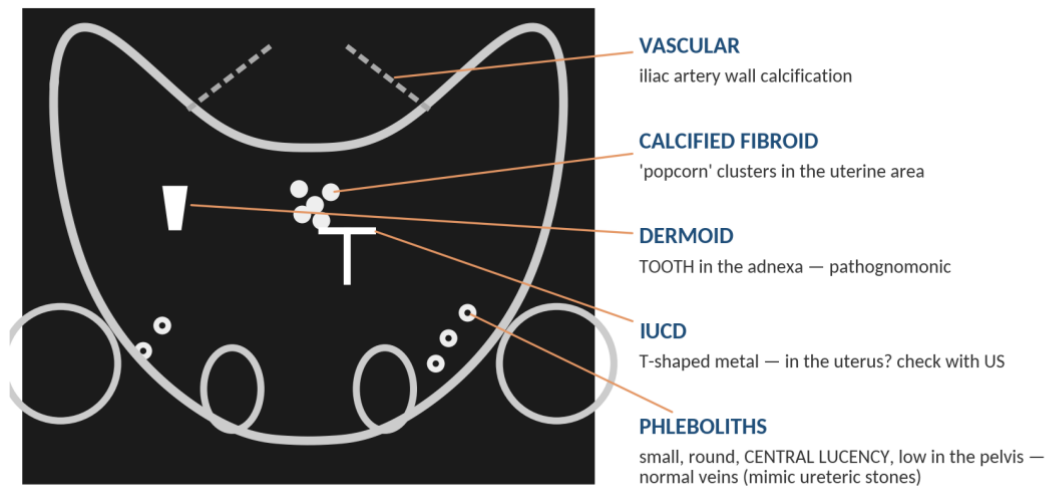


Figure 6. What the white spots mean.

Pattern	Likely cause
Small, round, central lucency, low in the pelvis	Phleboliths — normal (can mimic ureteric stones)
'Popcorn' in the uterine area	Calcified fibroid
Tooth-like in the adnexa	Dermoid (mature cystic teratoma)
Curvilinear, adnexal	Calcified ovarian cyst wall
Linear along vessels	Arterial calcification
T- or other device shape	IUCD

- Pitfalls: only **~10–15% of gallstones** are radio-opaque (vs most renal stones); an appendicolith suggests appendicitis.

5 Finding a 'Lost' IUCD

#	Step
1	Pregnancy test (and emergency contraception if needed)
2	Pelvic ultrasound — in the cavity? malpositioned?
3	Not seen on ultrasound → plain abdominal X-ray (metal shows anywhere in the abdomen/pelvis); nothing seen → expelled
4	Seen outside the uterus → laparoscopic retrieval

6 Hysterosalpingography (HSG)

INDICATIONS + TECHNIQUE

- Tubal patency in **subfertility**; cavity shape (recurrent miscarriage, anomalies); after tubal surgery
- **Days ~7–10** (after menses, before ovulation) — pregnancy excluded
- Cannula/balloon through the cervix; **water-soluble iodinated contrast** under fluoroscopy; films of cavity, tubes and **spill**

COMPLICATIONS

- Pain, vasovagal
- **Pelvic infection** (~1–3%) — **screen for chlamydia first, or give prophylaxis** (NICE)
- Contrast allergy (ask about previous reactions)
- Venous/lymphatic **intravasation**
- Radiation ~1 mSv

Hysterosalpingogram patterns (schematic)

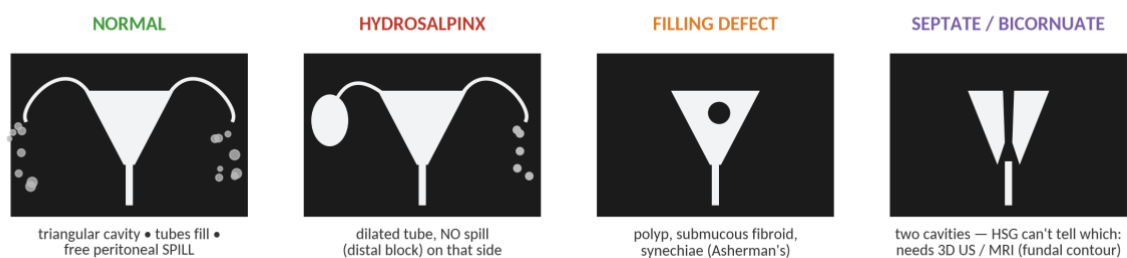


Figure 7. Normal and abnormal HSG.

- **HyCoSy** (ultrasound with saline/air or foam contrast) avoids radiation and iodine; **saline infusion sonography** assesses the cavity alone.

7 Pelvimetry and Fetal Radiography

- **Pelvimetry** predicts labour poorly and is **rarely used**. It is **not needed before vaginal breech birth** (RCOG GTG 20b) and doesn't reliably predict VBAC success. If ever done, **MRI** (no radiation) or low-dose CT is preferred.
- **Fetal radiography** is largely historical — ultrasound, 3D and MRI replace it. A **post-mortem skeletal survey** is still used for suspected skeletal dysplasia or fractures.

★ PEARL

The best plain film for perforation is the **ERECT CHEST X-ray** — a small amount of free gas shows as a crescent under the right hemidiaphragm. A supine abdominal film alone misses it often.

In a **pregnant woman with suspected appendicitis**: **ultrasound first, MRI second** — avoid radiation where possible.

8 MRCOG Exam Pearls — Last-Minute Page

Numbers to know

0.02 mSv Chest X-ray	~0.4–0.7 mSv Abdominal X-ray	~1 mSv HSG	~10 mSv CT abdomen/pelvis
~2.7 mSv UK background / year	~100 mGy Fetal deterministic threshold	3 / 6 / 9 cm Bowel limits	~10–15% Gallstones radio-opaque

HIGH-YIELD CHECKLIST

- ☐ Bremsstrahlung = main X-ray source; attenuation ↑ with density, atomic number, thickness.
- ☐ Five densities: gas, fat, soft tissue, bone, metal.
- ☐ IR(ME)R: justification, optimisation; 28-day rule (10-day rule for high-dose pelvic work).
- ☐ Fetal risk: all-or-nothing, organogenesis, CNS 8–15 wk; thresholds ~100 mGy.
- ☐ One diagnostic film never justifies termination; US then MRI in pregnancy.
- ☐ 3–6–9 rule; valvulae (small bowel) vs haustra (large bowel).
- ☐ Perforation: erect CXR; Rigler's, football, falciform signs; left lateral decubitus if can't stand.
- ☐ Phleboliths (central lucency), popcorn fibroid, dermoid tooth, IUCD.
- ☐ Lost IUCD: pregnancy test → US → AXR → laparoscopy.
- ☐ HSG days 7–10; water-soluble contrast; chlamydia screen or prophylaxis.
- ☐ Pelvimetry rarely useful; not required for breech.

Quick-fire self-test — cover the right-hand column

Question	Answer
Main mechanism producing diagnostic X-rays?	Bremsstrahlung (braking radiation)
What appears blackest on a plain film?	Gas
Most sensitive plain film for pneumoperitoneum?	Erect chest X-ray
Upper limit for normal small-bowel diameter?	3 cm
Mucosal folds that cross the full width of bowel?	Valvulae conniventes (small bowel)
Round pelvic calcification with a central lucency?	Phlebolith
Pathognomonic plain-film sign of a dermoid?	Tooth
First step for a 'lost' IUCD thread?	Pregnancy test
HSG sign of hydrosalpinx?	Dilated tube, no peritoneal spill
Imaging order for suspected appendicitis in pregnancy?	Ultrasound, then MRI
Most sensitive gestation for fetal CNS radiation effects?	8–15 weeks

9 References

- The Ionising Radiation (Medical Exposure) Regulations 2017.
- HPA / RCR / SCoR. Protection of pregnant patients during diagnostic medical exposures to ionising radiation. 2009.
- NICE CG156. Fertility problems: assessment and treatment. 2013 (updated 2017).
- FSRH Clinical Guideline: Intrauterine Contraception. 2023.