PIPADOR REVISION

MRCOG Part 1 Revision Notes

Radiation Complications

MEDICAL PHYSICS • LECTURE 512

VISUAL EXAMINATION REVISION NOTES

2026 Edition

512

MRCOG PART 1 REVISION NOTES | MEDICAL PHYSICS

Radiation Complications

Deterministic and stochastic effects, complications of pelvic radiotherapy, fetal effects and prevention

Deterministic	Stochastic	< 90 days	Vaginal stenosis
Threshold — tissue reactions	No threshold — cancer	Acute effects	Common late effect

■ KEY FACTS: Learning objectives

- Define deterministic (tissue reactions) and stochastic effects, and acute vs late radiation toxicity.
- Describe complications of pelvic radiotherapy (gynaecological, bowel, bladder, bone, lymphatic, endocrine) and their prevention and management.
- Describe fetal radiation effects, radiation in pregnancy and radiation effects on fertility.

512.1 Key definitions

Term	Definition
Deterministic effect (tissue reaction)	Effect occurring above a threshold dose, with severity increasing with dose (e.g. skin burns, cataract, infertility)
Stochastic effect	Effect whose probability (not severity) increases with dose, with no threshold — cancer induction and heritable effects
Acute (early) toxicity	• During or within 90 days of radiotherapy — affects rapidly dividing tissues • Usually reversible
Late toxicity	• More than 90 days (months–years) after treatment — fibrosis, vascular damage • Often permanent
Radiation proctitis/cystitis	Inflammation of rectum/bladder from radiation — late form with telangiectasia and bleeding
Pelvic insufficiency fracture	Fracture of radiation-weakened bone under normal load (sacrum, pubic rami)

■ IN PLAIN ENGLISH: Radiation complications

Radiation harms tissues in two ways: **predictable damage above a threshold** (like a sunburn — more dose, worse burn) and a **small chance of causing cancer** at any dose. Pelvic radiotherapy cures many women but can leave lasting effects on the vagina, bowel, bladder, bones and ovaries.

512.2 Types of radiation effect

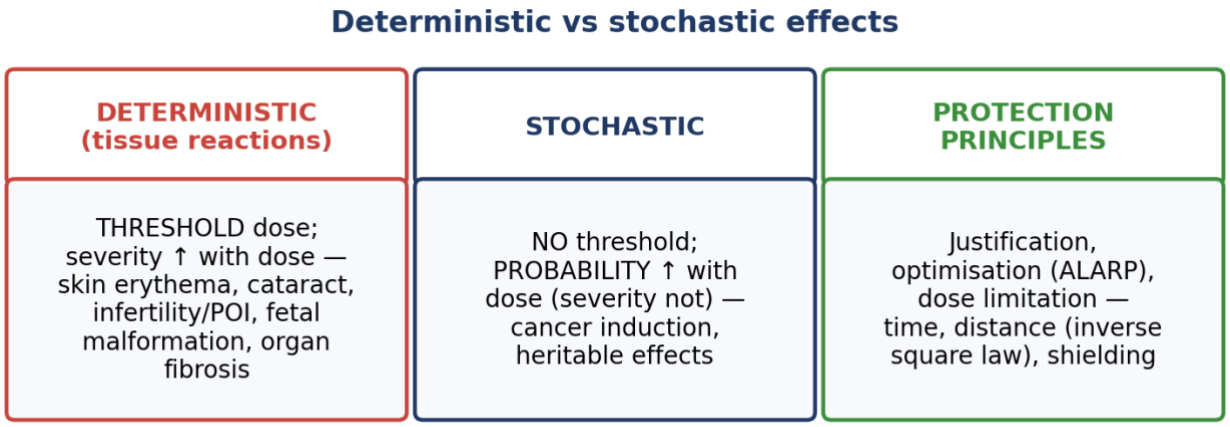


Figure 512.1 — Deterministic vs stochastic effects

512.3 Complications of pelvic radiotherapy

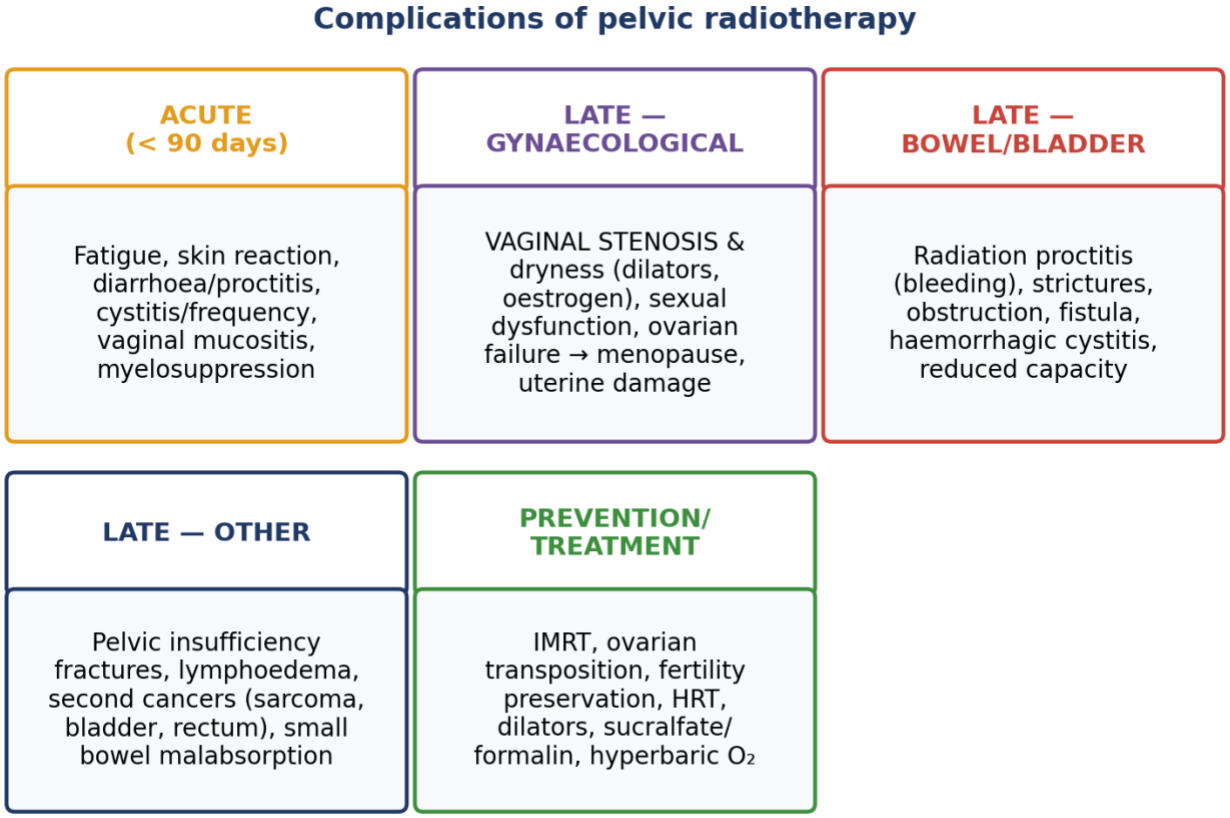


Figure 512.2 — Acute and late complications

Organ	Effects and management
Vagina	• Acute mucositis • Late stenosis, shortening, dryness, adhesions • Dyspareunia → vaginal DILATORS (start ≈ 2–8 weeks after treatment), lubricants • Vaginal oestrogen (if appropriate) • Psychosexual support

Organ	Effects and management
Ovaries	• Very radiosensitive (oocyte LD50 < 2 Gy) — POI after pelvic RT (dose of ≈ 5–20 Gy depending on age) → HRT until ≈ 51 unless contraindicated • Ovarian transposition (oophoropexy) before RT • Fertility preservation (oocyte/embryo cryopreservation)
Uterus	Reduced volume/blood flow — if pregnancy later: ↑ miscarriage, preterm birth, FGR, placenta accreta
Bowel	• Acute diarrhoea, cramps • Late proctitis (bleeding — sucralfate, formalin, argon plasma coagulation, hyperbaric oxygen), strictures, obstruction • Malabsorption (bile acid) • Fistula — gastroenterology referral (BSG pelvic radiation disease guidance)
Bladder	• Acute cystitis/frequency • Late haemorrhagic cystitis, reduced capacity, fistula
Bone	Pelvic insufficiency fractures, osteonecrosis (femoral head)
Lymphatics	Lower-limb lymphoedema (especially with lymphadenectomy) — compression, physiotherapy
Skin	Erythema, desquamation (groin/vulva) — skin care
Second cancers	Sarcoma, bladder, rectal cancers (years later) — stochastic
General	Fatigue, myelosuppression (especially with chemotherapy), psychological effects

512.4 Fetal radiation effects

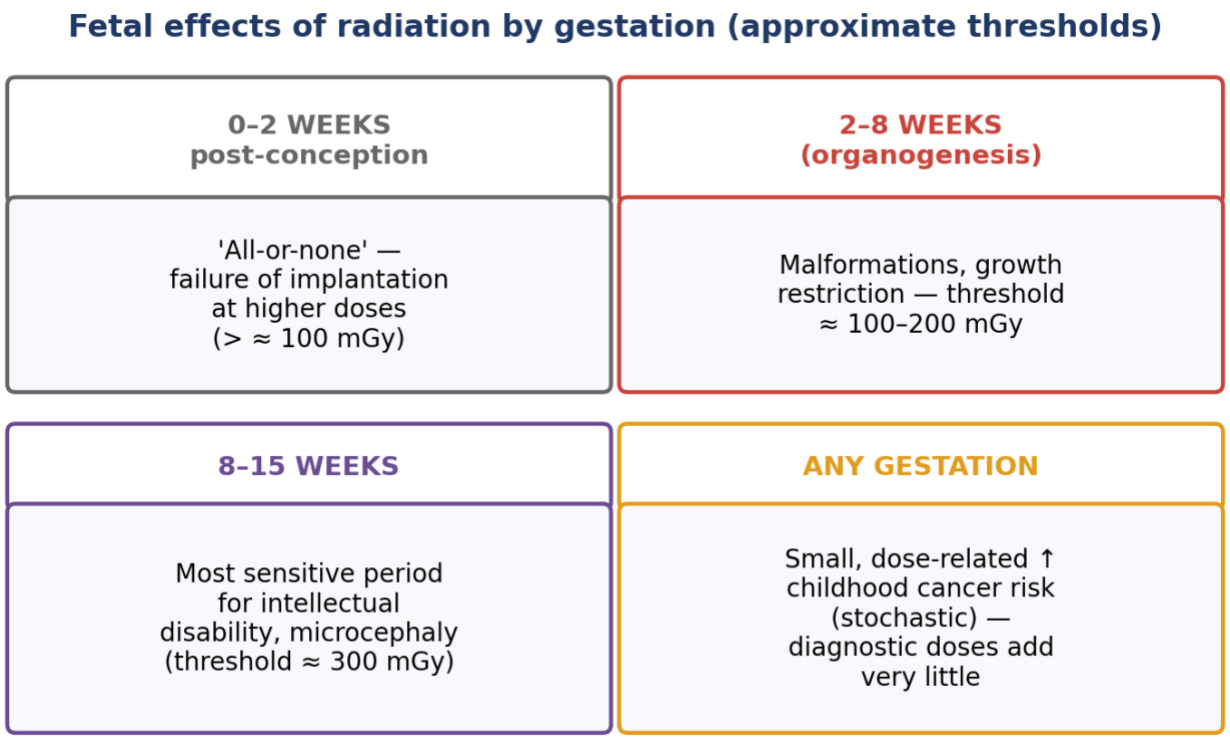


Figure 512.3 — Fetal effects by gestation

- Diagnostic imaging rarely exceeds 50 mGy to the fetus — **no measurable increase in malformations**
  - The main (small) concern is childhood cancer risk (stochastic), which is very low at these doses.

- Inadvertent exposure in early pregnancy: estimate dose with a medical physicist
  - Reassure in most cases
  - Termination is not indicated for typical diagnostic doses.
- Radiotherapy during pregnancy: generally avoided for pelvic tumours (fetal dose very high — fetal death/abortion)
  - Non-pelvic sites possible with shielding and physics input.
- Staff: pregnant workers declare pregnancy → fetal dose kept ≤ 1 mSv for the remainder of pregnancy (IRR17).

512.5 Prevention

- Modern techniques (IMRT/VMAT, IGRT, MRI-guided brachytherapy) reduce dose to bowel, bladder and bone marrow.
- Avoid combining radical surgery and radiotherapy when one modality suffices (↑ morbidity).
- Ovarian transposition, fertility preservation counselling and HRT planning before treatment.
- Survivorship care: late-effects clinics, education about dilators, bowel and bladder symptoms.

■ COMMON PITFALLS

Not counselling about vaginal dilators and sexual function.

Missing POI and failing to offer HRT after pelvic radiotherapy.

Attributing new rectal bleeding to radiation without investigating for recurrence/second cancer.

512.6 Must-know summary

■ EXAM TIP

- Deterministic: threshold, severity ∝ dose (skin, cataract, gonads, fetus); stochastic: no threshold, probability ∝ dose (cancer, heritable).
- Acute (< 90 days): mucositis, diarrhoea, cystitis, fatigue, marrow; late (> 90 days): vaginal stenosis, proctitis, cystitis, fistula, strictures, fractures, lymphoedema, second cancers.
- Ovaries highly radiosensitive → POI → HRT; ovarian transposition/fertility preservation beforehand.
- Fetus: 2–8 wk malformation threshold ≈ 100–200 mGy; 8–15 wk neurodevelopmental; diagnostic doses usually < 50 mGy.

■ MNEMONIC / MEMORY AID

Late pelvic RT effects — 'Vagina, Viscera (bowel/bladder), Vertebrae/bone, Vessels (lymphoedema), Very late cancers'.