PIPADOR REVISION

MRCOG Part 1 Revision Notes

Musculoskeletal System

PHYSIOLOGY • LECTURE 156

VISUAL EXAMINATION REVISION NOTES

2026 Edition

156

MRCOG PART 1 REVISION NOTES | PHYSIOLOGY

Musculoskeletal System

Bone and remodelling, muscle and neuromuscular transmission, pregnancy adaptations, the pelvis and pelvic floor

≈ 25–30 yr	T ≤ −2.5	≈ 50%	≈ 20%
Peak bone mass	Osteoporosis (DXA)	Pregnant women with back pain	Pelvic girdle pain in pregnancy

■ KEY FACTS: Learning objectives

- Describe bone structure, cells, remodelling and the effects of oestrogen, pregnancy and drugs.
- Describe skeletal, cardiac and smooth muscle and neuromuscular transmission.
- Describe musculoskeletal adaptations to pregnancy, the bony pelvis and the pelvic floor.
- Relate to osteoporosis, myasthenia gravis, malignant hyperthermia and childbirth injury.

156.1 Bone

Component	Detail
Matrix	Osteoid — type I collagen (≈ 90%) + hydroxyapatite ($Ca_{10}(PO_4)_6(OH)_2$); osteogenesis imperfecta = collagen I defect
Osteoblasts	Mesenchymal; synthesise osteoid, ALP, osteocalcin; express RANKL and OPG
Osteocytes	Embedded osteoblasts; mechanosensors; secrete sclerostin and FGF23
Osteoclasts	Monocyte/macrophage lineage, multinucleate; RANK → resorption (acid, cathepsin K); bisphosphonates and denosumab (anti-RANKL) inhibit
Types	Cortical (80%; compact) vs trabecular (20%; high turnover — vertebrae, hip — lost first after menopause)

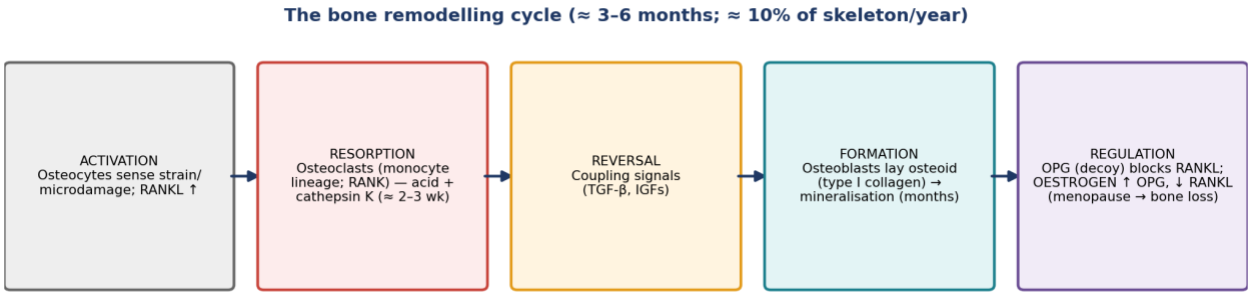


Figure 156.1 — The bone remodelling cycle and its regulation

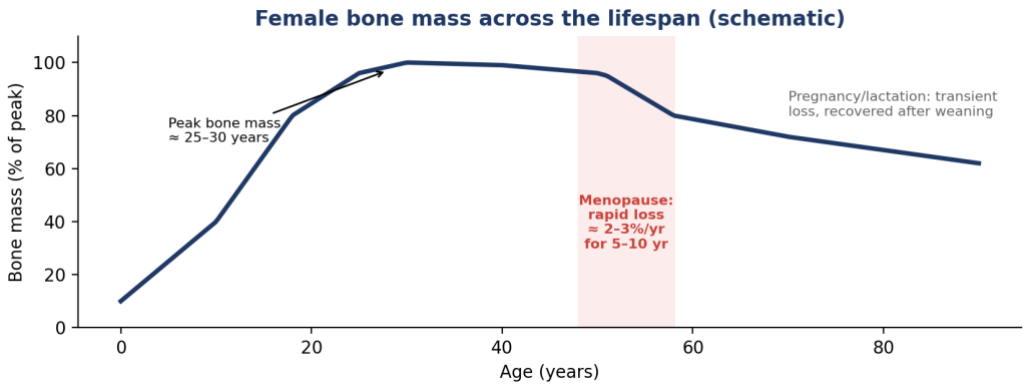


Figure 156.2 — Bone mass through life

Factor	Effect on bone
Oestrogen deficiency (menopause, POI, anorexia, GnRH analogues, DMPA)	↑ RANKL, ↓ OPG → ↑ resorption; HRT prevents bone loss
Pregnancy	↑ Ca absorption (Lecture 141); modest trabecular loss; pregnancy- and lactation-associated osteoporosis (rare vertebral fractures); transient osteoporosis of the hip
Lactation	≈ 3–10% loss (PTHrP, low oestrogen) — fully recovered after weaning
Heparin	Unfractionated heparin > LMWH (osteoporosis rare with LMWH)
Corticosteroids, PPIs, AEDs, thyroxine excess	↑ Fracture risk
Weight-bearing exercise, calcium, vitamin D	Protective

156.2 Muscle

	Skeletal	Cardiac	Smooth (myometrium, vessels)
Structure	Striated, multinucleate	Striated, branched, intercalated discs	Non-striated, spindle; gap junctions (connexin-43)
Control	Voluntary — somatic motor (NMJ)	Pacemaker; autonomic modulation	Autonomic, hormonal, stretch, intrinsic
Ca^{2+} trigger	DHPR mechanically opens RyR1 (SR)	Ca^{2+}-induced Ca^{2+} release (RyR2)	Extracellular + SR Ca^{2+}
Ca^{2+} binds	Troponin C	Troponin C	Calmodulin → MLCK
Clinical	Malignant hyperthermia (RyR1)	Lecture 125	Oxytocin, PGs; tocolysis (Lecture 147)

Motor nerve AP → Ca^{2+} entry → **ACh release** ▶ ACh binds **nicotinic receptors** → end-plate potential ▶ Muscle AP along T-tubules ▶ **DHPR → RyR1** → SR Ca^{2+} release → troponin C → cross-bridges ▶ Acetylcholinesterase ends signal

Disorder	Obstetric relevance
Myasthenia gravis (anti-AChR)	Variable course; $MgSO_4$ contraindicated (blocks ACh release → crisis) — use levetiracetam/phenytoin for eclampsia; avoid aminoglycosides; transient neonatal MG (10–20%) from IgG transfer; second stage may need assistance (striated muscle fatigue; uterus unaffected)
Malignant hyperthermia	Autosomal dominant RyR1 — triggered by volatile agents and suxamethonium → hypercarbia, rigidity, hyperthermia; dantrolene; neuraxial anaesthesia preferred

Disorder	Obstetric relevance
Myotonic dystrophy	Anticipation (maternal transmission → congenital DM1): polyhydramnios, reduced fetal movements; PPH (poor uterine contraction)
Suxamethonium / plasma cholinesterase	Cholinesterase ↓ ≈ 25% in pregnancy — prolonged block uncommon

156.3 Musculoskeletal adaptations to pregnancy

Change	Mechanism / clinical
Ligament laxity	Relaxin and progesterone remodel collagen — sacroiliac joints and symphysis pubis widen (normal ≈ 4–5 mm → up to ≈ 9 mm; > 10 mm = diastasis)
Posture	Centre of gravity moves anteriorly → lumbar lordosis, cervical flexion → back pain (≈ 50%)
Pelvic girdle pain / SPD	≈ 20%; physiotherapy, support belts; usually resolves postpartum
Diastasis recti	Separation of rectus abdominis along linea alba — common; postpartum physiotherapy
Nerve entrapments	Carpal tunnel, meralgia paraesthetica (Lecture 154)
Gait	Wider base, 'waddling'

156.4 The bony pelvis and pelvic floor

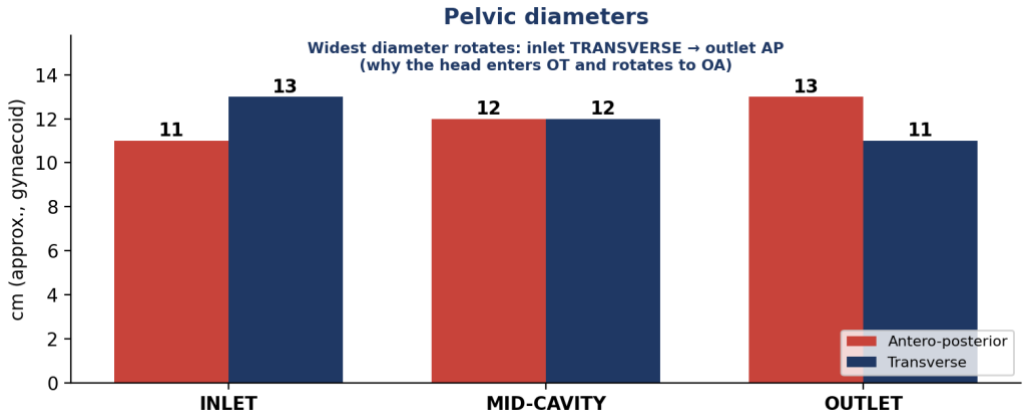


Figure 156.3 — Pelvic diameters (approximate)

Pelvic type (Caldwell–Moloy)	Frequency	Inlet shape / labour
Gynaecoid	≈ 50%	Round inlet — favourable
Android	≈ 20%	Heart-shaped; narrow forepelvis — OP positions, deep transverse arrest
Anthropoid	≈ 25%	Oval AP; direct OP/OA engagement
Platypelloid	≈ 5%	Flat; transverse engagement, difficult descent

- **Obstetric conjugate** (sacral promontory → back of symphysis) ≈ 10.5–11 cm — the smallest AP inlet diameter; **interspinous** diameter ≈ 10.5 cm (narrowest midpelvis).
- **Pelvic floor**: **levator ani** (pubococcygeus, puborectalis, iliococcygeus) + coccygeus; innervation **S2–4** (pudendal and direct branches). At crowning the levator stretches > 3-fold.
- **Childbirth injury**: levator **avulsion** (≈ 10–20% of vaginal births; ↑ forceps), pudendal neuropathy, **OASI** (3rd/4th-degree tears; RCOG GTG 29) → prolapse and incontinence; pelvic floor muscle training (NICE NG210).

156.5 Must-know summary

■ EXAM TIP

- Osteoblasts make bone and express RANKL/OPG; **oestrogen ↑ OPG** — menopause → resorption (trabecular bone first).
- Skeletal muscle: **DHPR–RyR1** coupling, troponin C; smooth muscle: **calmodulin–MLCK**.
- **$MgSO_4$ is contraindicated in myasthenia gravis**; malignant hyperthermia → dantrolene.
- Relaxin → symphysis widening, pelvic girdle pain; lordosis → back pain.
- Pelvic inlet widest **transverse**, outlet widest **AP**; gynaecoid ≈ 50%; levator ani S2–4.

■ MNEMONIC / MEMORY AID

Levator ani — 'PPI': Pubococcygeus, Puborectalis, Iliococcygeus. **RANKL Resorbs; OPG Opposes**.