PIPADOR REVISION

MRCOG Part 1 Revision Notes

Nervous System

PHYSIOLOGY • LECTURE 154

VISUAL EXAMINATION REVISION NOTES

2026 Edition

154

MRCOG PART 1 REVISION NOTES | PHYSIOLOGY

Nervous System

Neurons, autonomic system, pain and labour analgesia, CSF and neuraxial anatomy, and neurology of pregnancy

−70 mV	≈ 500 mL/day	T10–L1	S2–4
Neuronal resting membrane potential	CSF production (volume ≈ 150 mL)	1st-stage labour pain	2nd-stage pain (pudendal)

■ KEY FACTS: Learning objectives

- Describe the neuronal action potential, synaptic transmission, nerve fibre types and local anaesthetic action.
- Describe the organisation of the autonomic nervous system and its receptors.
- Describe pain physiology and the pathways of labour pain; relate to regional anaesthesia.
- Describe CSF, the blood–brain barrier and neurological changes and disorders in pregnancy.

154.1 Neurons and conduction

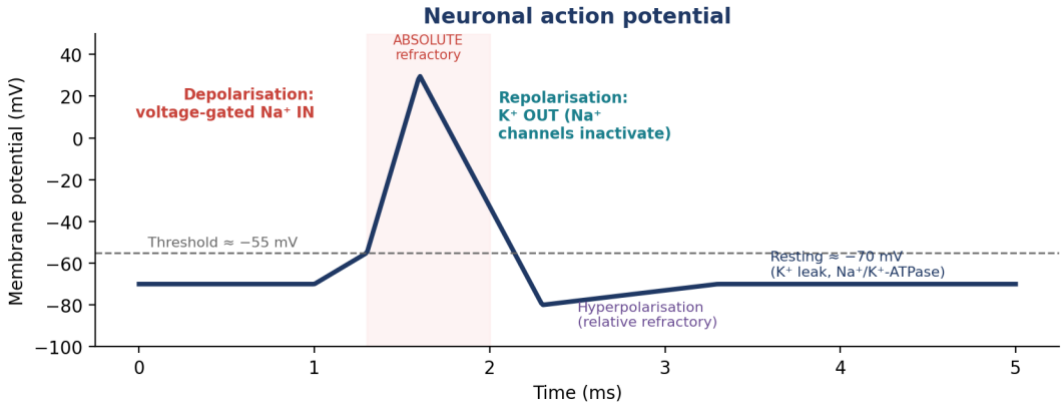


Figure 154.1 — The neuronal action potential

Fibre	Myelin	Diameter / speed	Function	LA sensitivity
Aα	Yes	12–20 µm; 70–120 m/s	Motor, proprioception	Least
Aβ	Yes	5–12 µm	Touch, pressure	↓
Aγ	Yes	3–6 µm	Muscle spindle tone	—
Aδ	Thin	2–5 µm; 5–30 m/s	Fast, sharp pain, cold	↑
B	Yes	< 3 µm	Preganglionic autonomic	Most (first blocked)
C	No	0.4–1.2 µm; 0.5–2 m/s	Slow, dull pain, warmth, postganglionic sympathetic	↑↑

- **Saltatory conduction** at nodes of Ranvier (myelin from Schwann cells — PNS; oligodendrocytes — CNS) increases speed and efficiency.
- **Local anaesthetics** block **voltage-gated Na^+ channels** from inside (un-ionised form crosses membrane) — **order of block: sympathetic (B) → pain/temperature (C, Aδ) → touch → motor**. Sympathetic block extends ≈ 2 segments higher than sensory → **hypotension** with spinal anaesthesia.
- **Pregnancy ↑ sensitivity to local anaesthetics** (progesterone; engorged epidural veins ↓ epidural space and CSF volume) → lower doses needed. **LA toxicity**: perioral tingling, tinnitus → seizures → arrhythmia/cardiac arrest — **Intralipid 20%** (AAGBI).

Neurotransmitter	Main roles
Acetylcholine	NMJ (nicotinic), all autonomic ganglia, parasympathetic effectors (muscarinic), sweat glands (sympathetic cholinergic)
Noradrenaline	Sympathetic postganglionic; CNS arousal
Glutamate / GABA	Main excitatory / inhibitory CNS transmitters (NMDA blocked by Mg^{2+} — $MgSO_4$ neuroprotection; GABA-A — benzodiazepines)
Dopamine	Inhibits prolactin; movement; antiemetic target
Serotonin, substance P, endorphins	Mood, nausea; pain transmission; endogenous analgesia (↑ in labour)

154.2 The autonomic nervous system

	Sympathetic	Parasympathetic
Outflow	Thoracolumbar (T1–L2)	Craniosacral (III, VII, IX, X; S2–4)
Ganglia	Paravertebral chain (near cord) — short pre, long post	Near/in target organ — long pre, short post
Postganglionic transmitter	Noradrenaline (α, β); ACh to sweat glands; adrenal medulla secretes adrenaline	Acetylcholine (muscarinic)
Pelvic organs	Hypogastric plexus: uterine vasoconstriction, bladder storage, emission	Pelvic splanchnic nerves: erection, micturition, defecation
Pregnancy	↑ Sympathetic tone (maintains BP with ↓ SVR)	Dominant fetal HR control by term (variability)

154.3 Pain

Nociceptors (free nerve endings): mechanical, thermal, chemical (bradykinin, PGs, H^+) → **Aδ** (fast) and **C** (slow) fibres → dorsal horn (substantia gelatinosa) → **Spinothalamic tract** (crosses) → thalamus → somatosensory cortex; limbic system (affect) → **Modulation**: gate control (Aβ inhibit — TENS, massage), descending opioid/serotonergic/noradrenergic pathways → Sensitisation (peripheral and central) → hyperalgesia

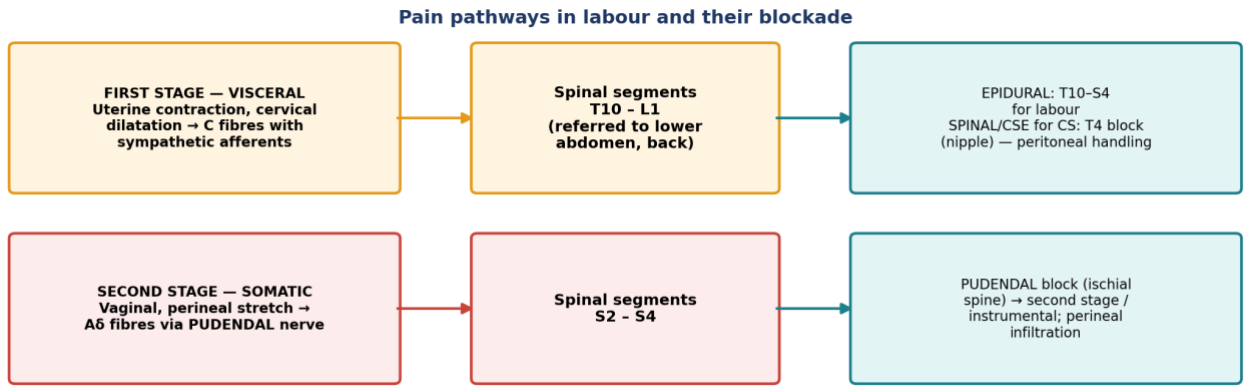


Figure 154.2 — Labour pain pathways and their blockade

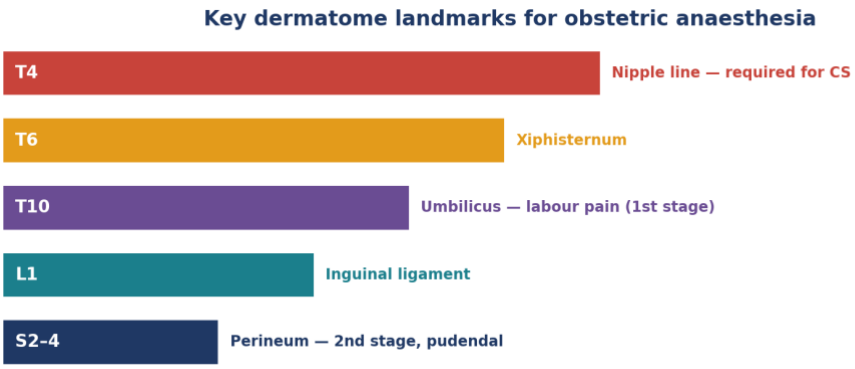


Figure 154.3 — Dermatome landmarks

154.4 CSF, blood–brain barrier and neuraxial anatomy

Topic	Key facts
CSF	Produced by choroid plexus (≈ 500 mL/day; ≈ 0.35 mL/min), volume ≈ 150 mL, reabsorbed via arachnoid granulations; pressure 10–18 cmH_2O; protein < 0.45 g/L, glucose ≈ 60% of plasma
Blood–brain barrier	Endothelial tight junctions + astrocyte foot processes; lipid-soluble drugs cross; immature in neonates (kernicterus)
Neuraxial landmarks	Spinal cord ends L1–L2 (adult; ≈ L3 neonate); dural sac S2; Tuffier's line (iliac crests) ≈ L4 — spinal injection below L2–3. Layers: skin → supraspinous → interspinous → ligamentum flavum (loss of resistance) → epidural space → dura → arachnoid → CSF
Post-dural puncture headache	Postural, fronto-occipital, ≈ 1% after epidural; CSF leak → traction; epidural blood patch; rule out subdural haematoma/cerebral venous thrombosis

154.5 Nervous system in pregnancy

Condition	Physiology / key points
Carpal tunnel syndrome	Fluid retention compresses median nerve (≈ 20–60%); 3rd trimester; resolves postpartum; splints
Meralgia paraesthetica	Lateral cutaneous nerve of thigh compressed under inguinal ligament (lordosis, weight)
Bell's palsy	↑ Risk in 3rd trimester/postpartum (oedema, pre-eclampsia)
Postpartum nerve palsies	Lumbosacral trunk (fetal head), common peroneal (lithotomy stirrups), femoral (prolonged hip flexion), obturator
Migraine	Often improves (stable oestrogen); new/changed headache → exclude pre-eclampsia, CVT, SAH, PRES
Epilepsy	Seizure frequency unchanged in most; valproate teratogenic (NTD, neurodevelopmental); folic acid 5 mg; SUDEP; levels fall (↑ clearance — lamotrigine)
Eclampsia / PRES	Loss of cerebral autoregulation, vasogenic oedema (posterior); $MgSO_4$ — NMDA antagonism, cerebral vasodilatation
Stroke / CVT	Hypercoagulability, pre-eclampsia, postpartum peak
Restless legs	↑ in 3rd trimester (iron deficiency, folate)

154.6 Must-know summary

■ **EXAM TIP**

- LAs block Na^+ channels: **B > C/Aδ > Aβ > Aα** — sympathetic block causes hypotension; pregnancy ↑ LA sensitivity.
- First-stage pain **T10–L1** (visceral, C fibres); second stage **S2–4** (pudendal, somatic); **T4 block for CS**.
- Sympathetic = **thoracolumbar**; parasympathetic = **craniosacral (S2–4 for pelvis)**.
- Cord ends **L1–L2**; dural sac S2; Tuffier's line L4.
- New headache in pregnancy: exclude **pre-eclampsia, CVT, SAH, PRES**.

■ **MNEMONIC / MEMORY AID**

LA block order — 'B Can't Always Move': B, C/Aδ, Aβ, then Aα (motor) last. **'S2, 3, 4 keeps the pelvic floor off the floor'** — pelvic splanchnic and pudendal nerves.