PIPADOR REVISION

MRCOG Part 1 Revision Notes

Urinary System Changes in Pregnancy

PHYSIOLOGY • LECTURE 152

VISUAL EXAMINATION REVISION NOTES

2026 Edition

MRCOG PART 1 REVISION NOTES | PHYSIOLOGY

152 Urinary System Changes in Pregnancy

Anatomical, haemodynamic and tubular changes; water and sodium handling; and clinical applications

↑ ≈ 50% GFR (from ≈ 6 weeks)	**↑ 50–80%** Renal plasma flow	**< ≈ 75–80** Creatinine µmol/L — higher is suspicious
≈ 90% Right-sided hydronephrosis by term	**< 30 mg/mmol** Urinary PCR (normal); ACR < 8 mg/mmol	**2–5%** Asymptomatic bacteriuria

■ KEY FACTS: Learning objectives

- Describe anatomical changes of the urinary tract in pregnancy.
- Describe changes in renal haemodynamics, tubular function, and water and electrolyte handling, with mechanisms.
- Interpret renal biochemistry and proteinuria in pregnancy.
- Apply these changes to UTI, pre-eclampsia, AKI, CKD and urinary retention.

152.1 Anatomical changes

Change	Detail / mechanism
Kidney size	Length ↑ ≈ 1–1.5 cm; volume ↑ ≈ 30% (↑ vascular and interstitial volume)
Physiological hydronephrosis / hydroureter	From the 1st trimester (progesterone ↓ ureteric peristalsis), more marked later (mechanical compression at the pelvic brim). Right > left (≈ 90%): dextrorotation of the uterus, right ovarian vein crossing, left ureter cushioned by sigmoid colon. Resolves by 6–12 weeks postpartum
Urinary stasis	Dilated collecting system holds up to ≈ 200 mL → ascending infection (pyelonephritis)
Bladder	Displaced anteriorly/superiorly; ↓ detrusor tone (progesterone) ↑ capacity early; later uterine pressure → frequency, urgency, nocturia, stress incontinence; mucosal oedema/hyperaemia
Vesicoureteric reflux	More common (ureteric dilatation, bladder displacement)

152.2 Renal haemodynamics and filtration

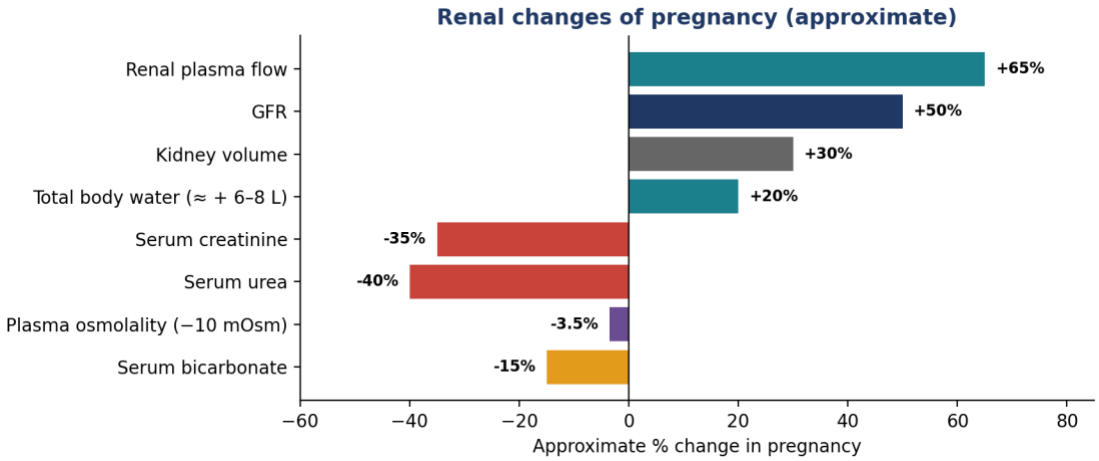


Figure 152.1 — Summary of renal changes in pregnancy

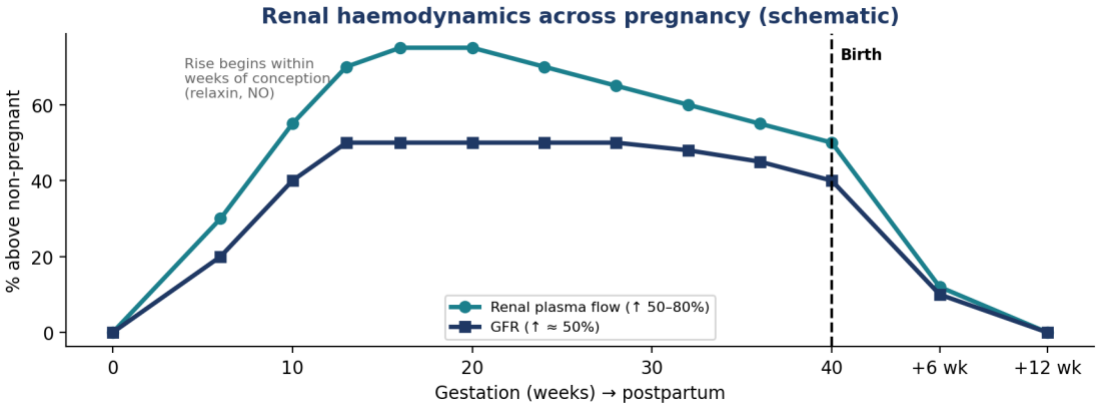


Figure 152.2 — Time course of renal plasma flow and GFR

Relaxin (corpus luteum) → endothelin-B → **NO** ▶ **↓ Renal vascular resistance** (afferent + efferent) ▶ ↑ Renal plasma flow (+ ↑ plasma volume, CO) ▶ ↓ Plasma oncotic pressure ▶ **GFR ↑ ≈ 50%** — begins within weeks of conception

- GFR peaks by the end of the 1st trimester and falls slightly in the last weeks; RPF rises more than GFR early (**filtration fraction ↓**), then falls towards term (filtration fraction rises).
- **Posture** matters: supine and upright positions reduce RPF and GFR in late pregnancy (caval compression); left lateral maximises them.
- **eGFR equations are not valid in pregnancy**; use serum creatinine trends (or 24-h creatinine clearance).

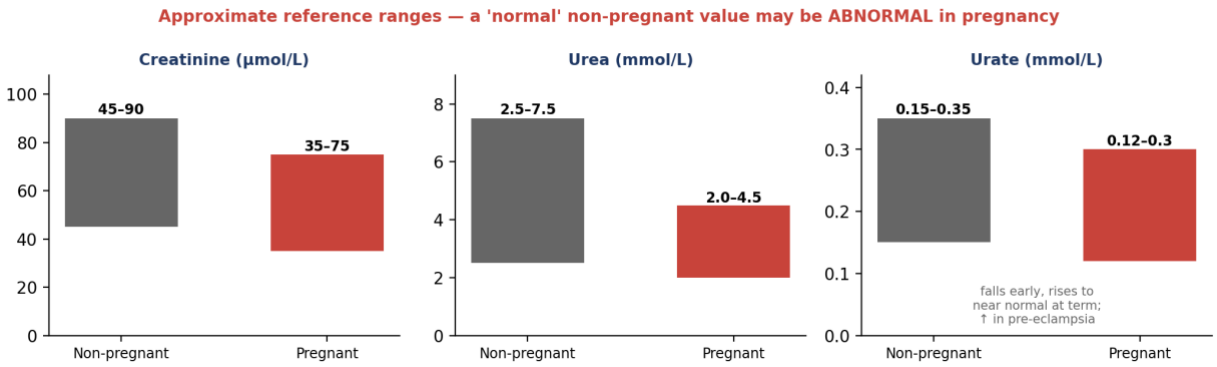


Figure 152.3 — Approximate reference ranges for renal biochemistry

■ **RED FLAGS**

- A creatinine of **90 µmol/L** — 'normal' outside pregnancy — **suggests renal impairment in pregnancy**. Rising creatinine, urate or urea should prompt assessment for **pre-eclampsia, sepsis, haemorrhage/AKI**.

152.3 Tubular function

Substance	Change	Mechanism / significance
Glucose	Glycosuria common	↑ Filtered load exceeds ↓ tubular reabsorption capacity — not diagnostic of diabetes (use OGTT/glucose criteria)
Amino acids, water-soluble vitamins	↑ Excretion	↑ Filtered load
Protein	↑ Excretion — upper normal ≈ 300 mg/24 h	Significant proteinuria: PCR ≥ 30 mg/mmol or ACR ≥ 8 mg/mmol (NICE NG133); dipstick 1+ needs quantification
Urate	↓ Early (↑ GFR), rises to non-pregnant levels at term	↑ in pre-eclampsia (↓ tubular clearance) — marker of severity, not diagnosis
Bicarbonate	↓ to 18–22 mmol/L	Renal compensation for respiratory alkalosis → ↓ buffering (faster metabolic acidosis)
Calcium	Urinary Ca^{2+} ↑ (absorptive hypercalciuria)	↑ $1,25(OH)_2D$; stone incidence not markedly ↑ (↑ inhibitors such as citrate, magnesium)
Potassium	Net retention (≈ 350 mmol)	Despite ↑ aldosterone — progesterone is anti-kaliuretic

152.4 Water and sodium

Change	Detail
Sodium retention	≈ 900 mmol cumulative; ↑ GFR raises filtered Na^+ by ≈ 5000–10,000 mmol/day — balanced by ↑ tubular reabsorption (aldosterone, oestrogen, deoxycorticosterone) vs natriuretic progesterone and ANP
RAAS	All components ↑ — but refractory to angiotensin II pressor effect (↑ PGI_2, NO); loss of refractoriness precedes pre-eclampsia
Osmoregulation	Osmotic thresholds for thirst and ADH reset ≈ 10 mOsm/kg lower (hCG, relaxin) → plasma osmolality ≈ 275–280 mOsm/kg; Na^+ ↓ ≈ 4–5 mmol/L
Placental vasopressinase	Degrades ADH (↑ with placental mass) → transient gestational diabetes insipidus (twins, AFLP/liver dysfunction reduces clearance of the enzyme); treat with desmopressin (resistant to vasopressinase)
Total body water	↑ 6–8 L (≈ 4–6 L extracellular) → physiological oedema

152.5 Clinical applications

Condition	Physiological link / key points
Asymptomatic bacteriuria	2–5%; stasis + glycosuria; ≈ 20–30% progress to pyelonephritis if untreated — screen with MSU at booking (NICE) and treat
Pyelonephritis	Usually right-sided; risk of sepsis, ARDS, preterm labour; IV antibiotics
Pre-eclampsia	Glomerular endotheliosis (swollen endothelium, occluded capillaries) → ↓ GFR, proteinuria, ↑ urate/creatinine; oliguria — restrict fluids (≈ 80 mL/h) to avoid pulmonary oedema
AKI in pregnancy	Pre-renal (hyperemesis, haemorrhage, sepsis), intrinsic (pre-eclampsia/HELLP, TTP/aHUS, AFLP, ATN, cortical necrosis after abruption), post-renal (rare; ureteric injury at CS)

Condition	Physiological link / key points
Chronic kidney disease	Outcome depends on baseline creatinine, proteinuria and BP: ↑ pre-eclampsia, FGR, preterm birth, and permanent decline if creatinine is significantly raised; low-dose aspirin; ACEi stopped (fetotoxic)
Renal colic	Hard to distinguish from physiological dilatation — ultrasound with ureteric jets / Doppler resistive index; MRI if needed
Urinary retention	Incarcerated retroverted uterus (≈ 12–16 wk); postpartum after epidural/instrumental birth — monitor first void (within 6 h); overdistension causes long-term detrusor damage

152.6 Must-know summary

■ EXAM TIP

- **RPF ↑ 50–80%, GFR ↑ ≈ 50%** (from ≈ 6 weeks) — driven by relaxin–NO vasodilatation.
- **Creatinine, urea and urate fall**; creatinine > ≈ 75–80 µmol/L warrants review; eGFR invalid.
- **Physiological hydronephrosis — right > left**, resolves 6–12 weeks postpartum; stasis → pyelonephritis.
- Glycosuria is common and **not diagnostic**; proteinuria significant if **PCR ≥ 30 or ACR ≥ 8 mg/mmol**.
- Osmostat resets **10 mOsm/kg lower**; placental **vasopressinase** → transient DI (desmopressin).

■ MNEMONIC / MEMORY AID

'Right Ureter Dilates' — dextrorotation, iliac/ovarian vein crossing, no sigmoid cushion. **'Everything filtered goes up; everything measured in blood goes down'** (creatinine, urea, urate, HCO_3^-, Na^+, osmolality).