CRF may be asymptomatic but defined as GFR<60ml/min. Equates with stage 4 chronic kidney disease (CKD) or stage 5 CKD (established renal failure).

Stage of CKD	eGFR (estimated GFR)
Stage 1 CKD – w/o another abnormality, regard as normal	>90ml/min/1.73m^2 with another abnormality*
Stage 2 CKD - otherwise regard as normal	60-89ml/min/1.73m^2 with another abnormality*
Stage 3 CKD	30-59ml/min/1.73m^2 (moderate impairment)
Stage 4 CKD	15-29ml/min/1.73m^2 (severe impairment)
Stage 5 CKD	<15ml/min/1.73m^2 (established renal failure)

*e.g. already known to have proteinuria, haematuria (but no urological cause), microalbuminuria (in diabetes), polycystic disease or reflux nephropathy

Causes

- Renovascular disease and hypertension
- Glomerulonephritis
- Diabetes
- Infective, obstructive and reflux nephropathies
- Familial or hereditary kidney disease, e.g. polycystic kidneys
- Hypercalcaemia
- Connective tissue diseases
- Analgesic or other drug nephropathy
- Neoplasms & myeloma

Presentation

Symptoms

- Non-specific symptoms caused by RF, Cx (e.g. anaemia) and the underlying disease.
- May be discovered by chance following a routine blood or urine test.
- Specific symptoms in severe renal failure include anorexia, nausea, vomiting, fatigue, weakness, pruritus, lethargy, peripheral oedema, dyspnoea, insomnia, muscle cramps, pulmonary oedema, nocturia, polyuria and headache.
- Sexual dysfunction is common.
- Hiccups, pericarditis, coma and seizures are only seen in very severe renal failure.

Signs

- May reveal underlying cause or Cx of CRF (e.g. anaemia, bleeding diathesis, pericarditis).
- Also ↑skin pigmentation or excoriation, pallor, ↑BP, postural hypotension, peripheral oedema, LVH, PVD, pleural effusions, peripheral neuropathy and restless legs syndrome.

Investigations

Urinalysis: Micro for cells, casts (RBC or tubular), crystals. Protein:creatinine ratio.

Bloods: UEC (↓Na$^+$, ↑K$^+$, ↑Cr, ↑Ur), eGFR, glu, CMP (↓Ca, ↑Mg, ↑PO$_4$), FBC, albumin, LFT, lipids, immunological screens as indicated (ANA, ANCA, antiDNAse B, C', specific antibodies)

Imaging: CXR (for APO), renal artery Doppler, USS, DTPA scan, MRI/MRA, CT (obstructive)

ECG: recent MI, hyperkalaemia

Other: Renal biopsy

Complications

- Hypertension: left ventricular hypertrophy, heart failure, CVA, cardiovascular disease
- Electrolyte disturbance ($\downarrow Na^+$, $\uparrow K^+$, $\downarrow Ca^{2+}$, $\downarrow Mg^{2+}$, $\uparrow PO_4$)
- Renal osteodystrophy: disorders of Ca, P, and bone, 2° hyperparathyroidism
- Fluid overload: pulmonary oedema, hypertension
- Anaemia: ($\rightarrow$ fatigue, LVF, impaired cognitive functioning)
- Neurological: uraemic encephalopathy, neuropathy including peripheral neuropathy
- Malnutrition: increased morbidity and mortality, infections, poor wound healing
- Also: coagulopathy, glucose intolerance, dialysis amyloid

Acute on Chronic Renal Failure

- Renal hypoperfusion
- Obstruction and infection of the urinary tract: urinary retention,
- Metabolic and toxic: DKA, hyperCa, hyperuricaemia, contrast media, drugs
- Progression of underlying diseases, e.g. relapse of glomerulonephritis, accelerated HT
- Renal vein thrombosis: usually occurs in chronically nephrotic patients
- Pregnancy: pre-eclampsia

Management

Early:

- Tight control of hypertension
- Fluid restriction if oliguric
- Consider ACE inhibitor or ARB if urine prot:Cr>100mg/mmol or micro-albuminuria in DM.
- Protein restriction
- PO_4^- binders
- Avoidance of nephrotoxins, e.g. IV radiocontrast agents, NSAIDs, aminoglycosides.
- Immunise against influenza, hepatitis B and pneumococcus.

Late:

- Na^+ & K^+ restriction
- Calcium ± vitamin D supplementation
- Dialysis – see Renal Replacement Therapy/Transplantation article
  - Peritoneal: uses 1.3 – 2.5% dextrose diasylate.
  - Haemodialysis
- Multivitamins (vit B complex, folic acid, vit C) & FeSO4 for dialysis losses
- Erythropoeitin to maintain Hb 110-120g/L
- Renal transplantation – see Renal Replacement Therapy /Transplantation article