

The kidney has several functions including:

- Excretion - soluble waste e.g. urea and creatinine, and foreign materials e.g. drugs.
- Water/electrolyte/acid-base balance.
- Endocrine: production of vitamin D, erythropoietin, and renin axis.

Investigations

Urinalysis

- Appearance - blood, colour, turbidity.
- Specific gravity - sticks measure ionic particles only, not glucose.
- pH - normally acidic, except after a meal.
- Glucose - glycosuria may indicate increased blood glucose, or tubular disorder.
- Protein - proteinuria may be caused by, glomerular leak, raised serum low molecular weight proteins, Bence Jones proteins, myoglobin, or protein of renal origin.
- Microscopy - UTI will show polymorphs with no casts, acute glomerulonephritis will show cells and casts, chronic glomerulonephritis shows little sediment.

Glomerular filtration rate (GFR)

A measurement of clearance of a fully filtered substance = $([X]_U \times \text{Vol}/\text{Min}) / [X]_P$

- Inulin GFR is the gold standard for measurement, but is a complex procedure.
- Isotopic GFR is also sometimes performed using radioactive isotopes.
- 24hr Creatinine clearance is often used as a rough measurement of GFR.
- Estimated GFR (eGFR) calculated from the plasma Cr alone is only a very rough guide. [unmht://file.5/C:/Medical/FACEM/Revision Notes/Renal/BGP 25300%3b Assessing Renal Function%3b %28Version=22%29.mht/DisplayFullScr - ref1](http://unmht://file.5/C:/Medical/FACEM/Revision%20Notes/Renal/BGP%2025300%3b%20Assessing%20Renal%20Function%3b%28Version=22%29.mht/DisplayFullScr-ref1)
 - Creatinine is produced by the muscles at a relatively constant level by the body., Thus plasma Cr depends on the rate of excretion by the kidneys. Levels are affected by age, gender, ethnic group, muscle bulk, ingestion of cooked meat, malnutrition and some drugs e.g. trimethoprim. Various equations take some of these factors in to account to improve the estimate. E.g. Cockcroft-Gault Formula:

$$\text{Male CrCl (}\sim\text{GFR) ml/min} = \frac{(140 - \text{age}) \times \text{ideal wt}}{0.814 \times [\text{serum Cr}]} \quad (\text{For Female multiply this by } 0.85)$$

- The eGFR is then used to assess the severity of the chronic kidney disease.

Stage of CKD	eGFR (normalised here to surface area)
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