



RENAL FUNCTION TESTS

Baseline studies may include: electrolytes, creatinine, urea, calcium, phosphate, albumin; FBC

ELECTROLYTES

40-100 mmol/24 hours (varies with intake).

Differentiation of renal potassium loss from other causes of hypokalaemia.

Mineralocorticoid excess, some renal tubular disorders, metabolic alkalosis, some diuretics and Bartter's syndrome cause renal potassium loss.

With decreased intake or increased GIT loss, renal potassium loss is decreased.

SODIUM - URINE

In hyponatraemia or hypovolaemic shock without acute tubular necrosis, urine sodium should be <20 mmol/L and fractional excretion of sodium should be $<1.5\%$.

If extracellular fluid volume and plasma sodium are normal, urine sodium should equal intake minus non-renal losses, typically 75-300 mmol/24 hours.

Investigation of Hyponatraemia (low sodium in the blood)

Assessment of renal function in hypovolaemic shock.

Investigation of compliance with a low sodium diet.

Investigation of predisposing factors for hypercalciuria in patients with renal calculi.

Urinary sodium excretion exceeds 20 mmol/L in hyponatraemia due to SIADH, diuretic therapy, or Addison's disease.

In a patient with shock and oliguria a urinary sodium >20 mmol/L or a fractional excretion of sodium $>1.5\%$ suggests acute tubular necrosis.

High urine sodium increases urine calcium and predisposes to calculi containing calcium.

CREATININE – Plasma or Serum

Dependant on age

Child (<12 years): 0.04-0.08 mmol/L

Adult female: 0.05-0.11 mmol/L

Adult male: 0.06-0.12 mmol/L.

Detection of decreased glomerular filtration.

CREATININE CLEARANCE

1. Creatinine clearance (mL/sec) =

$$\frac{\text{urine creatinine (mmol/L)} \times \text{urine volume (mL)}}{\text{plasma creatinine (mmol/L)} \times \text{time of collection (seconds)}}$$

The patient's height and weight should be measured so that surface area can be calculated and creatinine clearance adjusted to the 'standard' body surface area of 1.73m².

Cockcroft and Gault formula:

Creatinine clearance (mL/sec) males =

$$\frac{(140 - \text{age}) \times \text{weight (kg)}}{72 \times \text{plasma creatinine (mmol/L)}}$$

Creatinine clearance (mL/sec) females =

$$\frac{0.85 (140 - \text{age}) \times \text{weight (kg)}}{72 \times \text{plasma creatinine (mmol/L)}}$$

1.5-2.3 mL/sec (corrected for body surface area).

Assessment of glomerular filtration rate, and hence glomerular function.

More sensitive than serum creatinine for the detection of early glomerular dysfunction, but significant decreases in creatinine clearance may not occur until up to 30% of glomeruli cease to function.

Complete and accurately timed urine collections are essential.



Urea –plasma or serum

Neonate: 1.0-4.0 mmol/L

Adult: 3.0-8.0 mmol/L

Investigation of renal function.

Increased levels are seen with reduced glomerular filtration due to renal or pre-renal disease; bleeding into the gastrointestinal tract; hypercatabolic states.

Reduced values are seen in pregnancy; with water retention; with reduced synthesis as a result of decreased protein intake, severe liver disease, or urea-cycle defects.

Calcium

Corrected calcium algorithms vary, but typically:

Corrected calcium (mmol/L) = total calcium (mmol/L) + 0.02 (40 - albumin [g/L]).

Ionised calcium - ion selective electrode.

Total calcium: 2.10-2.60 mmol/L

Corrected calcium: 2.15-2.60 mmol/L

Ionised calcium: 1.16-1.30 mmol/L

(i) Diagnosis of hypercalcaemia. Investigation of patients with clinical features of hypercalcaemia or other features of hyperparathyroidism; malignancy esp lung, multiple myeloma, kidney, bony metastases; sarcoidosis: vitamin D or vitamin A toxicity.

(ii) Diagnosis of hypocalcaemia. Investigation of patients with clinical features of hypocalcaemia or other features of hypoparathyroidism, renal failure, osteomalacia or rickets. Evaluation of patients after thyroid or parathyroid surgery, or during massive blood transfusion.



Phosphate - Plasma

Adult: 0.8-1.5 mmol/L

Levels are slightly higher in children.

Assessment of patients with renal failure, metabolic bone disease, hyper- and hypo-parathyroidism.

Increased phosphate levels are found in response to low parathyroid hormone levels (eg, hypoparathyroidism, hypercalcaemia due to malignancy and other non-parathyroid causes) and in renal failure.

Decreased levels of phosphate are usually found in patients with primary hyperparathyroidism, in some cases of hypercalcaemia associated with malignancy, in renal tubular disorders and in patients using magnesium and aluminium containing antacids.

Levels may be decreased during prolonged intravenous therapy if phosphate supplementation is inadequate. Phosphate levels may also be decreased following a carbohydrate-rich meal, due to cellular uptake of phosphate.

Numerous other conditions can affect serum phosphate levels.

Albumin

32-45 g/L. Varies with age

Assessment of hydration, nutritional status, protein-losing disorders and liver disease.

Decreased levels may be associated with overhydration, chronic liver disease, protein losing disorders (eg, nephrotic syndrome, protein-losing enteropathy), malnutrition, and shifts into the extravascular space (eg, burns).

Decreased levels may also be seen as part of an acute phase response.

Increased levels may be seen with dehydration