

MANAGEMENT OF CALCIUM, MAGNESIUM, PHOSPHATE AND PTH IN HAEMODIALYSIS PATIENTS

i. Electrolyte Targets:

<u>Renal CMP Target ranges</u>
Corrected Calcium 2.1 - 2.4 mmol/L
PO ₄ 0.8 - 1.8 mmol/L
Mg 0.7 - 1.0 mmol/L
Intact PTH 15 - 42 pmol/L
Calcium-phosphate product – less than 4 mmol ² /L ²

ii. Management of Calcium, magnesium, phosphate & Parathyroid hormone

Calcium

Calcium is predominantly transported bound to serum proteins, consequently total calcium levels are greatly influenced by albumin concentration. Always correct total calcium for hypoalbuminaemia, i.e. albumin below 40g/L

$$\text{Corrected Ca} = (40 - \text{albumin}) \times 0.02 + \text{serum Ca}$$

$$\text{Calcium-phosphate product} = \text{Corrected Ca} \times \text{serum PO}_4$$

Measurement of ionised Ca is not routinely performed, but may be more useful in the case of severe hypocalcaemia. The sample collection procedure is not routine. Please refer to the protocol of “Management of patients having parathyroidectomy for secondary or tertiary hyperparathyroidism” & “hypocalcaemia protocol”.

Refer to the “selection of dialysate concentration in haemodialysis WPI” if corrected Ca level is outside of the target range.

Hypercalcaemia

If corrected Ca level is > 2.4 mmol/L. MO to cease or reduce Ca based phosphate binders & Vitamin D supplement. If corrected Ca is > 3.0mmol/L or symptomatic (nausea, vomiting, abdominal, bone pain, bradycardia, arrhythmia and confusion), MO to urgently review. For longer-term control of hypercalcaemia in patients with more severe or symptomatic hypercalcemia (due to excessive bone resorption), bisphosphonates may be administered. Refer to hypercalcaemia protocol

Hypocalcaemia

If corrected Ca level is < 2.1 mmol/L MO informed. If corrected Ca level is < 1.9 mmol/L or symptomatic (cramps, facial numbness, tingling to lips, fingers & toes, Chvostek’s signs, convulsion, respiratory failure, ECG prolonged QT interval and myocardial contractility), MO to conduct urgent review. Refer to hypocalcaemia protocol & management of patients having parathyroidectomy for secondary or tertiary hyperparathyroidism protocol.

Magnesium

Hypermagnesemia

If Mg level is > 1.0 mmol/L, MO to reduce or cease magnesium based phosphate binders. If Mg level is > 5 mmol/L, MO to be called for urgent review. Severe hypermagnesemia can cause respiratory failure, hypotension, arterio-ventricular block.

Hypomagnesaemia

Hypomagnesaemia results in a decreased in PTH, calcium and potassium level. If Mg level is < 0.5 mmol/L, MO to conduct urgent review. Symptoms of associated with hypermagnesemia include arrhythmia, seizure, coma.

Phosphate

If PO₄ is outside of the target range, MO to review of phosphate binders. The risk of calcium-phosphate precipitation increases when CaPo₄ product exceeds 4 mmol²/L².

Hyperphosphatemia

If PO₄ > 1.8 mmol/L, assess patient's compliance with diet & medication. Refer to a dietician for dietary phosphate restriction. Educate patient on medication administration such as timing of phosphate binders. Monitor Hdx adequacy and evaluate Hdx prescription such as HDx time, blood flow & dialyser size. HDF improves phosphate clearance. Perform regular vascular assessment to detect AVF recirculation problem. Discuss with patient home haemodialysis option if patient is suitable for home therapy. Longer, frequent HD & nocturnal HD improve phosphate clearance.

Hypophosphatemia

If PO₄ <0.32 mmol/L MO to urgently review. Symptoms of hypophosphatemia can be severe. (muscle weakness, bone pain, rhabdomyolysis, altered mental status respiratory failure, arrhythmia and seizure) Hypophosphatemia may occur in the patient receiving prolong and intensive dialysis such as frequent nocturnal dialysis, high cut off dialysis (HCO) and continuous renal replacement therapy (CRRT). Phosphate Fleet may be added to dialysate concentrate if pre dialysis phosphate is constantly <0.8mmol/L. Refer to Myeloma high cut off dialysis protocol or home haemodialysis nocturnal dialysis protocol.

PTH

If PTH is outside of the target range, MO to review Vitamin D or other medication. Consider using lower Ca dialysate if patient has adynamic bone disease with PTH <11. Parathyroidectomy for tertiary hyperparathyroidism may require.

iii. Blood monitoring

- To commence or change the dosage of medications.
Requires fortnightly and sometimes monthly monitoring of serum corrected calcium and phosphorus until stable and monthly monitoring of plasma PTH until stable.
- To commence or change the dosage of phosphate binders or Vitamin D
Corrected calcium and phosphorus should be monitored monthly & plasma PTH should be measured monthly for at least 3 months and then every 3 months once target levels of PTH are achieved.
- Post Parathyroidectomy
Calcium, phosphate and PTH must be closely monitored. See protocol for management of patients having parathyroidectomy for secondary or tertiary hyperparathyroidism.

iv. Common medication

Vitamin D	Rocaltrol, Calcitriol
Calcium based phosphate binders	Caltrate, Titalac, Cal-600, Cal-sap
Calcium free & Aluminium free phosphate binders	Sevelamer (Renagel), Lanthanum (Fosrenol)
Aluminium based phosphate binders	Alutab
Magnesium based phosphate binders	Mylanta, Magmin
Aluminium and Magnesium based phosphate binders	Gastrogel
Calcimimetic agent	Cinacalcet (Sensipar)
Bisphosphonates	Pamidronate (APD, Aredia)