PHOSPHATE

SCOPE (Area): FOR USE IN: Critical Care Unit, ED, Theatre and General Wards
EXCLUSIONS: Paediatrics (seek Paediatrician advice)
SCOPE (Staff): Medical, Nursing and Pharmacy

Note: Ballarat Health Services stocks the following two intravenous phosphate containing products.

Sodium phosphate and potassium phosphate
13.4 mmol phosphate, 2.6 mmol potassium and 21.4 mmol sodium per 20 mL
For phosphate supplementation as described in this guideline.

Potassium dihydrogen phosphate and dipotassium hydrogen phosphate
14.5 mmol phosphate and 25 mmol potassium per 10 mL
Not used for phosphate supplementation (has a much higher potassium content and is reserved for the treatment of hypokalaemia complicated by hyperchloraemia where potassium chloride administration is not appropriate).

BRAND NAMES
DBL Sodium Phosphate and Potassium Phosphate Concentrated Injection®.

PHARMACOLOGY AND PHARMACOKINETICS
Phosphate has an essential role in bone structure and is also important in many metabolic and enzymatic pathways. 80% of phosphate in the body is present as calcium phosphate, giving rigidity to the bone. The remainder is involved with energy storage and transfer, utilisation of B complex vitamins, buffering of body fluids and renal excretion of hydrogen ions. Phosphate is primarily excreted in the urine. Serum phosphate levels are inversely related to serum calcium levels and to renal metabolism of vitamin D.

INDICATIONS
- Treatment of moderate and severe hypophosphataemia – see Dosage and Administration.

CONTRAINDICATIONS
- Severe renal impairment (CrCl less than 30 mL/min) – increased risk of hyperphosphataemia.
- Hyperphosphataemia.
- Hypocalcaemia – due to the close link between hypocalcaemia and hyperphosphataemia.
- Hyperkalaemia – potassium contained in injection may exacerbate hyperkalaemia.
- Hypernatraemia - sodium contained in injection may exacerbate hypernatraemia.
- Addison’s disease – increased risk of hyperkalaemia.
- Urolithiasis – may exacerbate infected magnesium ammonium phosphate urolithiasis.
PRECAUTIONS

- Conditions where hyperkalaemia or hypernatraemia may occur (including drugs that contain or increase potassium or sodium) – use with caution due to the sodium and potassium content of the ampoules.
- Conditions where high phosphate levels may occur (including drugs that contain phosphate) - e.g. hypoparathyroidism, chronic renal disease and rhabdomyolysis.
- Conditions where low calcium levels may occur - e.g. hypoparathyroidism, osteomalacia, chronic renal disease, acute pancreatitis, rhabdomyolysis and rickets.
- Mild to moderate renal impairment - dose reduction is required. See Dosage and Administration and Monitoring.

PREGNANCY AND BREASTFEEDING

Seek specialist advice before prescribing, information may update regularly.

DRUG INTERACTIONS

- Digoxin – can result in hyperkalaemia in patients with severe or complete heart block.
- Calcium containing medications - may increase risk of deposition of calcium in soft tissues.
- Salicylates – can increase concentration of salicylates as excretion of salicylate is decreased in urine acidified by phosphate.
- See Precautions.

DOSAGE AND ADMINISTRATION

<table>
<thead>
<tr>
<th>Dosing information is for patients with normal renal function, doses should be reduced by at least half in mild to moderate renal impairment. For severe renal impairment see Contraindications. Seek expert advice if unsure.</th>
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</thead>
<tbody>
<tr>
<td>Extravasation can cause tissue necrosis, administer by CVC or large peripheral vein only.</td>
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<tr>
<td>Always dilute ampoules as outlined below before use.</td>
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</table>

Doses are to be prescribed as multiples of complete ampoules, rather than multiples of phosphate 10 mmol as often quoted in references. Each ampoule contains 13.4 mmol phosphate, 2.6 mmol potassium and 21.4 mmol sodium in 20 mL.

Prescribe order in mmol (example below for 13.4 mmol):

“Phosphate 13.4 mmol (as sodium phosphate and potassium phosphate)”, together with appropriate dilution and rate information on the Intravenous Orders chart (MR/645.0).

Rapid complete correction of severe abnormality can be dangerous, partial correction is generally the best immediate option.

**Moderate hypophosphataemia (asymptomatic)**

Serum phosphate 0.4-0.7 mmol/L.

Oral administration (should be used in preference to IV administration where possible)

Phosphate (Phosphate-Sandoz®) 500 mg effervescent tablets, 500-1000 mg orally tds dissolved in half a glass of water. Dose selected depends on degree of hypophosphataemia and may be limited by diarrhoea.

Oral phosphate needs to be spaced 2 hours from antacids, iron, calcium, magnesium, sucralfate.
and 4 hours from colestipol (all of which can decrease phosphate absorption). Vitamin D preparations (cholecalciferol and calcitriol) can increase phosphate absorption leading to hyperphosphataemia.

Each tablet contains phosphate 16.1 mmol, potassium 3.1 mmol and sodium 20.4 mmol. This amount of potassium and sodium should be taken into account where clinically relevant. Approximately two thirds of the phosphate dose (about 10.7 mmol per tablet) is absorbed orally.

**IV administration**
May be required where oral administration is impractical.

**GENERAL WARDS (via large peripheral vein or CVC)**
Phosphate 13.4 mmol (20 mL from ONE ampoule of sodium phosphate and potassium phosphate) added to 500 mL sodium chloride 0.9%, given by IV infusion over 4 hours.
Total volume: 520 mL.
Rate of infusion: 130 mL/hr.

If fluid restricted:
Phosphate 10 mmol (15 mL from ONE ampoule of sodium phosphate and potassium phosphate) added to a 100 mL minibag of sodium chloride 0.9%, given by IV infusion over 4 hours.
Total volume: 115 mL.
Rate of infusion: 29 mL/hr.

**CRITICAL CARE UNIT, ED, THEATRE (via CVC)**
Phosphate 13.4 mmol (20 mL from ONE ampoule of sodium phosphate and potassium phosphate) added to a 100 mL minibag of sodium chloride 0.9%, given by IV infusion over 4 hours.
Total volume: 120 mL.
Rate of infusion: 30 mL/hr.

**Severe or symptomatic hypophosphataemia**
Serum phosphate <0.4 mmol/L.
Signs and symptoms can include anorexia, muscle weakness, rhabdomyolysis, osteomalacia, haemolytic anaemia, impaired leukocyte and platelet function, paralysis, confusion, left ventricular dysfunction, heart failure, arrhythmias, progressive encephalopathy, seizures, coma and death.

**GENERAL WARDS**
**Discuss management and possible transfer to Critical Care Unit with Critical Care Unit Medical Staff**

**CRITICAL CARE UNIT, ED, THEATRE (via CVC)**
Phosphate 13.4 mmol (20 mL from ONE ampoule of sodium phosphate and potassium phosphate) added to a 100 mL minibag of sodium chloride 0.9%, given by IV infusion over 2 hours.
Total volume: 120 mL.
Rate of infusion: 60 mL/hr.

If still symptomatic post dose seek Medical advice immediately. Repeat blood tests (see Monitoring) and/or dose if clinically indicated.

Note: for fluid restricted ICU patients with a CVC see DRG0048: Antibiotic and Electrolyte volumes for fluid restricted ICU patients (via CVC only).
General Administration Information

- **Infusion preparation:**
  Mix infusion thoroughly after adding phosphate to avoid inadvertently giving a more concentrated dose.
  Other compatible infusion fluid may be substituted where deemed necessary by the Medical Officer, however glucose may exacerbate hypophosphataemia.
  Infusion stable for 24 hours.

- **Infusion pump:** Imed

- **Routes of administration:**
  - IV injection: No
  - IV intermittent infusion (15-60 minutes): No
  - IV continuous infusion: Yes
  - IM injection: No
  - Subcut injection: No

- **Compatible/incompatible IV drugs/fluids:**
  Note: Incompatible with magnesium and calcium.
  Consult the Australian Injectable Drugs Handbook (‘Yellow book’) in your ward area. Assume all unlisted drugs and IV fluids are incompatible – contact Pharmacy for further advice.

MONITORING (INCLUDING BLOOD TESTS)

- Serum sodium, potassium, phosphate, magnesium, calcium and renal function should be monitored at baseline and post IV dose (if patient still symptomatic seek Medical advice immediately, or if asymptomatic at 6-12 hours). See Dosage and Administration regarding impaired renal function.

- Monitor for any signs of tetany. A rapid increase in phosphate levels can lead to a sudden decrease in calcium levels resulting in tetany. If tetany occurs cease infusion, seek medical assistance, take blood (for serum sodium, potassium, phosphate, calcium, magnesium and renal function) and commence an ECG.

- Avoid excessive supplementation as hyperphosphataemia can lead to soft tissue calcification, including of the eye, lung, heart and kidney.

- As well as hypocalcaemia and hyperphosphataemia, monitor for hyperkalaemia, hypernatraemia, and hypomagnesaemia.

NURSING PRACTICE POINTS

- Report any signs of tetany (involuntary muscle contraction) to Medical Officer and cease infusion. See Monitoring.

- Monitor IV site for phlebitis. If patient complains of severe pain or burning of injection site or limb, cease infusion and contact Medical Officer. Extravasation can cause tissue necrosis – see Dosage and Administration.

- Rapid infusion can lead to hypotension and dysrhythmia. Monitor heart rate, respiratory rate and blood pressure when phosphate is infused at 13.4 mmol over 2 hours.

- Blood tests as ordered by the Medical Officer – see Monitoring.

- Discard any solution that is discoloured, hazy or contains visible particulates.

ADVERSE EFFECTS

- **Extravasation** – can cause tissue necrosis. See Dosage and Administration.

- **Uncommon** – hypotension, fluid retention (swelling feet/lower limbs, weight gain), hyperkalaemia (confusion, tiredness, weakness, irregular or slow heart rate, numbness/tingling around lips/hands/feet, unexplained anxiety, weakness or heaviness of legs, shortness of breath), hypernatraemia (confusion, tiredness, weakness, convulsions, oliguria, tachycardia, headache,
dizziness, increased thirst). Hyperphosphataemia, hypocalcaemia or hypomagnesaemia can lead to convulsions, muscle cramps, numbness, tingling, pain or weakness in hands or feet, shortness of breath, tremor.

- **Rare** – acute renal failure, myocardial infarction.

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**DRUG PRESENTATIONS, LOCATION AND STORAGE**

Sodium phosphate dibasic dodecahydrate 3.84 g and potassium phosphate monobasic 348 mg in 20 mL ampoules.

Contains 13.4 mmol phosphate, 2.6 mmol potassium and 21.4 mmol sodium per 20 mL ampoule.

Imprest Locations (at the time of guideline development): CCU.

Store below 25°C.