Phosphate Intravenous for Adults (as sodium or potassium salts)

Who can administer

SODIUM phosphate

- May be administered by registered competent doctor or nurse/midwife.

POTASSIUM phosphate

- **Infusions prepared at ward level using ampoules**
  - May be administered by registered competent doctor or nurse/midwife, PROVIDED the guidelines below (in Methods of Administration) have been adhered to

Important information

- Intravenous phosphate **is potentially dangerous, consider oral route first. The IV route can cause fatal hypocalcaemia**, or **renal failure due to calcium phosphate precipitation in the kidneys and possibly fatal arrhythmias** (ref 1)
- **Oral/enteral replacement** is PREFERRED if level >0.4mmol/L AND asymptomatic. (ref 1)
- Patients with **HYPOcalcaemia** should have their calcium corrected before replacing phosphate to prevent further hypocalcaemia and risk of tetany (ref 1-3)
- Patients with **severe HYPERcalcaemia** who require phosphate replacement: seek specialist advice
- **Phosphate binders** such as aluminium, magnesium or calcium salts and sevelamer **should be stopped where possible** (ref 3)
- **Give in a dedicated line** due to documented **incompatibility** problems with **parenteral nutrition,calcium and magnesium containing solutions**(ref 2)

Available preparations

Table 1: Available preparations

Phosphate salt	Volume	Phosphate content per vial/ampoule/bag	Sodium content per vial/ampoule/bag	Potassium content per vial/ampoule/bag
Natriumphosphat Braun (sodium phosphate)	20ml	12mmol	20mmol	nil
Potassium phosphate (Braun)	20ml	12mmol	nil	20mmol
Phosphate polyfusor pre-mixed bag - very severe hypophosphataemia. **Supplied only on request.**	500ml	50mmol	81mmol	9.5mmol

Reconstitution

Already in solution

Ampoules should be diluted further prior to administration

Infusion fluids

Sodium chloride 0.9% (preferred) (ref 6)

Glucose 5% may also be used if clinically appropriate

Methods of intravenous administration

Intermittent intravenous infusion (using an electronically controlled infusion device)

- Administer as per guidelines below
- More aggressive regimens are occasionally used in the Critical Care Unit

Addition of potassium phosphate concentrate to infusion bags

- Preparation must be done **jointly by a doctor and a nurse** in the clinic room.
- Both the Controlled Drug register, and the Additive label **must be signed** by the SAME doctor and nurse
- UNUSED ampoules must immediately be returned to the CD press and signed back into the CD register by the SAME doctor and nurse
- Clearly over-label the infusion bag to reflect the TOTAL amount of mmol of potassium phosphate
- After adding potassium phosphate concentrate to an infusion bag, squeeze and invert bag a **MINIMUM** of ten times to avoid inadvertent administration of a toxic bolus [(ref 1)]

Dose in adults

- It is difficult to provide concrete guidelines for the treatment of severe HYPOphosphataemia because it is an intracellular ion, thus the extent of total body deficits and response to therapy are difficult to predict.

- **Most HYPOphosphatemic patients will not require therapy other than that correcting the underlying cause (see table below)**

- **Unexpected/severe HYPOphosphatemia should prompt a repeat check to exclude transient shifts between body compartments.** (Ref 3)

Table 2: Common causes of hypophosphataemia (ref 3)

Redistribution of PO4 into cells	Increased PO4 urinary excretion	Decreased PO4 GI absorption
• Respiratory alkalosis (hyperventilation) • Refeeding syndrome • Recovery from diabetic ketoacidosis • Drug therapy (insulin, carbohydrate infusions, catecholamines) • Sepsis • Malignancy	• HYPERparathyroidism • Disorders of vitamin D metabolism • Post kidney transplant • Volume expansion • Malabsorption • Renal tubular defects • Alcohol abuse • Metabolic/respiratory acidosis • Drug therapy (e.g. diuretics, acetazolamide, iron infusions, certain chemotherapy, antivirals, anticonvulsants and antibiotics, as well as other CYP450-inducing agents) • HYPERcalcaemia • Extensive burns	• Severe dietary phosphate restriction • Antacid abuse • Vitamin D deficiency • Chronic diarrhoea • Steatorrhoea • Malabsorption • Malnutrition • Phosphate binders in patients with chronic renal impairment

Oral/enteral replacement

- This is PREFERRED if level >0.4mmol/L AND asymptomatic. (Ref 1)
- Phosphate-Sandoz effervescent tablets contain 16.1mmol phosphate, 3.1mmol potassium and 20.4mmol sodium per tablet
- Usual dose: One - two tablets three times a day (max 96mmol/day)
- Oral supplementation may be poorly tolerated due to diarrhoea - if this occurs ensure the dose is diluted in at least 120ml water or consider IV replacement.

IV supplementation (potassium or sodium phosphate)

- ONLY if level <0.4mmol/L OR symptomatic with level 0.4 to 0.6mmol/L.
- **Suggest: Senior medical review before administration of intravenous Phosphate**
- Risks associated with IV use include hypocalcaemia (tetany), calcium-phosphate precipitation in the kidneys, and fatal arrhythmias

Table 3: Dose calculation - using Natrium Phosphate Braun 12mmol per 20ml															
FIRST LINE: Sodium Phosphate is the preferred salt (this is due to risks associated with the administration of IV Potassium)															
Â	**Dose**			**Duration**			**Comments**								
Level >0.4mmol/L	0.1 to 0.2mmol/kg *			over 6 hours			Max dose 30mmol/24hrs								
Level <0.4mmol/L	0.25 to 0.5mmol/kg			over 8 to 12 hours			Max dose 50mmol/24hrs								
*** Doses rounded above for ease- actual allowable range 0.08 to 0.24mmol/kg**															
mmol Phosphate required	6 mmol	9 mmol	14 mmol	17 mmol	20 mmol	23 mmol	26 mmol	29 mmol	32 mmol	35 mmol	38 mmol	41 mmol	44 mmol	47 mmol	50 mmol
Volume of Sodium phosphate injection required	10ml	15ml	23ml	28ml	33ml	38ml	43ml	48ml	53ml	58ml	63ml	68ml	73ml	78ml	83ml
Infusion volume	250ml Infusion						500ml infusion								

Table 4: Dose calculation using Potassium Phosphate Braun 12mmol per 20ml							
SECOND LINE: Potassium phosphate - may be preferred if co-existing hypokalaemia							
Â	**Dose**			**Duration**		**Comments**	
Level >0.4mmol/L	0.1 to 0.2mmol/kg *			Over 6 hours		Max dose 30mmol/24hrs	
Level <0.4mmol/L	0.25 to 0.5mmol/kg			Over 12 hours (due to K^+content)		Max dose 50mmol/24hrs	
*** Doses rounded above for ease- actual allowable range 0.08 to 0.24mmol/kg**							
mmol Phosphate required	6mmol	9mmol	14mmol	17mmol	20mmol	23mmol	26mmol
Volume of Potassium phosphate injection required	10ml	15ml	23ml	28ml	33ml	38ml	43ml
Add to infusion volume	500ml Infusion			1000ml infusion			

- The dilutions above refer to administration via peripheral lines. Higher concentrations may be used for central lines (ref 2)
- The phosphate **infusion** must be charted on the patient's prescription sheet (i.e. not just the fluid balance chart)

Fluid restriction

- Consider the use of suitable volume from a phosphate polyfusor (50mmol per 500ml)

Renal impairment

- Use oral and intravenous doses with caution in severe renal impairment - oral route should be first line. Dosage adjustment will be required for both IV and PO supplementation. (ref 3, 4)
- Administer slowly in renal impairment

Monitoring

- Monitor fluid balance and blood pressure
- Monitor ECG, particularly if the potassium salt is being used
- Monitor the following electrolytes every 6 to 12 hours:

Phosphate

- Rapid or excessive phosphate replacement through intravenous dosing can lead to hyperphosphataemia
- Phosphate is an intracellular anion and therefore serum concentrations are not an exact measurement of total body stores

Calcium

- Calcium-phosphate precipitation in soft tissue may cause hypotension and organ damage and can result in acute renal failure
- Intravenous calcium and phosphate must not be co-administered - significant risk of precipitation in the line

Magnesium

- Administration of intravenous phosphate can lead to hypomagnesaemia

Potassium

- Care with rate of administration of potassium phosphate salts- too rapid may be fatal
- Caution with potassium salts: Cardiac disease, conditions predisposing to hyperkalaemia - renal/adrenocortical insufficiency, acute dehydration or extensive tissue destruction as occurs in severe burns. Also risk of cardiac arrythmias with rapid administration (ref 5)

Sodium

- Due to the sodium content of solutions used, caution in hypertensive patients, or those with heart failure or oedema

Storage

- Potassium phosphate ampoules are treated as a **controlled drug in GUHs** (as it is a potasisum concentrate as well as containing phosphate). The routine supply of potassium phosphate is restricted to designated wards which are likely to be caring for critically ill patients
- Phosphate Polyfusor is NOT treated as a controlled drug

- Sodium phosphate is NOT treated as a controlled drug.
- Store below 25^{0}C

References

1. Uptodate. Hypophosphataemia: Evaluation and Treatment Sept 2021. Accessed 2nd November 2021
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4. Uptodate. Sodium phosphate: Drug information
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8. BNF- accessed via Clinical Key
9. Cork Emergency Medicine 2021 (Emed.ie) IV sodium phosphate. Accessed 2nd November 2021
10. Trissel ASHP

Therapeutic classification

Intravenous nutrition