Emergency Department Guidance for the Initial Treatment of Electrolyte Disorders

Contents

Hypomagnesaemia (low magnesium)

Mild (Magnesium 0.5 – 0.7 mmol/L)
1st Line Oral: Magnesium Aspartate 10mmol sachets; 1 sachet twice daily or Magnesium glycerophosphate 8mmol (2 x 4mmol tablets) three times a day Recheck magnesium level after 3 days – this can be done in the community if patient is being discharged. **2nd Line Intravenous:** 10mmol magnesium sulphate in 100-1000ml 0.9% sodium chloride or 5% dextrose over 90 minutes
Moderate (Magnesium 0.4 – 0.5 mmol/L)
Either* **Oral:** Magnesium Aspartate 10mmol sachets; 1 sachet twice daily or Magnesium glycerophosphate 8mmol (2 x 4mmol tablets) three times a day Recheck magnesium level after 3 days – this can be done in the community if patient is being discharged. **OR Intravenous:** 20mmol magnesium sulphate in 100-1000ml sodium chloride 0.9% or glucose 5% over 3-12 hours
Severe (Magnesium <0.4 mmol/L)
Intravenous: 20mmol magnesium sulphate in 100-1000ml sodium chloride 0.9% or glucose 5% over 3-12 hours.

*Consider:

- Side effects of oral replacement (GI upset)
- Ability to take oral medications
- Patient journey – inpatient or outpatient management

Hypophosphataemia (low phosphate)

Moderate (Phosphate 0.3 – 0.6 mmol/L)

1st line Oral:
Phosphate Sandoz 1-2 tablets three times a day

Recheck phosphate level after 3 days – this can be done in the community if patient is being discharged.

2nd line Intravenous:
Intravenous infusion as below

Severe (Phosphate <0.3 mmol/L) or oral route unsuitable

All patients need an ECG

Intravenous:
Polyfusor® infusion as below, max rate up to 5ml/kg over 12-24 hours (0.5mmol/kg over 12-24 hours). Can be given over 6-12 hours if necessary.
Once the desired volume has been infused, stop the infusion and discard any unused infusion.

	Weight 40-60 kg		**Weight 61 – 80 kg**		**Weight 81 – 120 kg**	
	Amount of phosphate	Volume of polyfusor	Amount of phosphate	Volume of polyfusor	Amount of phosphate	Volume of polyfusor
Phosphate <0.3 mmol/L	25 mmol	250 mL	35 mmol	350 mL	50 mmol	500 mL
Phosphate 0.3 – 0.6 mmol/L, oral route unavailable	10 mmol	100 mL	15 mmol	150 mL	20 mmol	200 mL

If Phosphate Polyfusor® is unavailable:
20 mmol sodium glycerophosphate (Glycophos©) in 250 mL of 5% glucose **or** 0.9% sodium chloride, over 10 hours
Can be repeated daily until phosphate is in normal range

Hyperkalaemia (high potassium)

Mild (potassium 5.0 – 5.9 mmol/L)
If renal function at baseline and patient is asymptomatic, may be suitable for discharge with dietary advice If acute kidney injury, treat as per AKI guidelines
Moderate (potassium 6.0 – 6.4 mmol/L) and Severe (potassium ≥6.5 mmol/L)
All patients need an ECG Patients with ECG changes* should have continuous cardiac monitoring – seek senior support Check blood glucose before starting treatment **If any ECG changes*:** 30 mL of 10% calcium gluconate IV over 10 minutes, via large peripheral vein or central venous catheter (In patients in digoxin, give over 30 minutes) Repeat ECG after treatment to ensure resolution of changes Give repeat dose of calcium gluconate after 5-10 minutes if ECG changes persist **All patients:** 10 units of soluble insulin (Actrapid) in 250 mL of 10% glucose IV over 30 mins **Or** 10 units of soluble insulin (Actrapid) in 50 mL of 50% glucose over 15 mins (fluid restricted patients) **And** 10mg salbutamol via nebuliser (as long as HR <120) If acute kidney injury, refer to AKI guidelines for advice on management of metabolic acidosis, and for formulary advice on oral agents to reduce potassium Continue treatment until serum potassium <5.5 mmol/L for at least 4 hours If pre-treatment blood glucose was <7.0 mmol/L, consider an infusion of 250 mL of 10% glucose over 5 hours to avoid hypoglycaemia All patients need potassium and glucose monitoring in line with trust guidance

***ECG changes in hyperkalaemia:**

- Peaked T waves
- Broad or flat P waves, PR interval prolongation
- Broad QRS with bizarre morphology
- Bradyarrhythmias and AV conduction blocks

Hypokalaemia (low potassium)

For all patients with hypokalaemia, check magnesium and replace as necessary

Mild (Potassium 3.0 – 3.4 mmol/L)
All patients need an ECG* – if any changes then follow severe low potassium guideline below. If no ECG changes then use oral treatment. **Oral:** Sando-K 2 tablets three times a day Recheck potassium level after 3 days – this can be done in the community if patient is being discharged.
Moderate (Potassium 2.5 – 2.9 mmol/L) with no ECG changes
All patients need an ECG* – if any changes then follow severe low potassium guideline below. If no ECG changes then use oral treatment. **Oral:** Sando-K 2 tablets four times a day Recheck potassium level after 3 days – this can be done in the community if patient is being discharged.
Severe (Potassium <2.5 mmol/L) or any low potassium with ECG changes
Intravenous: 40 mmol potassium chloride in 1000 mL sodium chloride over at least 2 hours (maximum rate 20 mmol/hour) All patients need continuous ECG monitoring

*ECG changes in hypokalaemia:

- Increased P wave amplitude
- Prolongation of PR interval
- Widespread ST depression and T wave flattening/inversion
- Prominent U waves (best seen in the precordial leads V2-V3)
- Apparent long QT interval due to fusion of T and U waves (= long QU interval)

Hypercalcaemia (high calcium)

Mild (Calcium 2.60 – 3.00 mmol/L) and Moderate (Calcium 3.01 – 3.40 mmol/L)
If symptomatic*, treat as severe (below) **Asymptomatic, unknown cause:** Most asymptomatic patients can be investigated as an outpatient Cause of hypercalcaemia may be determined by history and examination Review medications for known drug causes of hypercalcaemia, ensure any calcium and vitamin D therapies are suspended Check bone profile, PTH, U&Es If malignancy suspected then use ED suspicious cancer referral form to refer to 2WW clinic **Known malignancy:** Involve oncology and/or palliative care to determine best plan for patient Treatment is usually only indicated in symptomatic patients For full regional guidance click here
Severe (Calcium >3.40 mmol/L) or any symptomatic hypercalcaemia*
Unknown cause: All patients need inpatient admission Rehydrate with 4-6 L of 0.9% sodium chloride over 24 hours (adjust according to cardiovascular status in elderly patients and patients with renal impairment) Review medications for known drug causes of hypercalcaemia, ensure any calcium and vitamin D therapies are suspended Check bone profile, PTH, U&Es **Known malignancy:** Involve oncology and/or palliative care early to determine best plan for patient If being admitted, rehydrate with 1-3 L of 0.9% sodium chloride, over 24-48 hours (depending on cardiovascular status) For full regional guidance click here

*Signs and symptoms of hypercalcaemia

- Bone pain, pathological fractures
- Change in mental status
- Lethargy, muscle weakness
- New neurological signs (hypotonia, hyporeflexia, ataxia)
- Nausea, vomiting, weight loss
- Constipation
- Renal colic
- Thirst, polydipsia, polyuria
- New hypertension
- ECG changes – prolonged PR interval, short QTc

Hypocalcaemia (low calcium)

For all patients with hypocalcaemia:

- Always check magnesium level and replace magnesium first if it is low
- Add on vitamin D, phosphate and PTH – advice on replacing vitamin D here
- Take a careful medication history to look for drug causes of hypocalcaemia (full guidance here)

Mild (Corrected calcium 2.00 – 2.20 mmol/L) and asymptomatic*
Oral: Adcal D3 one tablet twice a day If unable to swallow then give intravenous treatment as per severe/symptomatic guideline below
Moderate (Corrected calcium 1.90 – 2.00 mmol/L) and asymptomatic*
All patients need an ECG. Patients with ECG changes** need continuous cardiac monitoring. **Oral:** Adcal D3 one tablet twice a day **or** Calcichew D3 forte one tablet twice a day If unable to swallow then give intravenous treatment as per severe/symptomatic guideline below
Severe (Corrected calcium <1.90 mmol/L) or symptomatic*
Intravenous: 10mL of 10% calcium gluconate in 50mL sodium chloride 0.9% or Glucose 5% over 10 minutes. Repeat doses as needed until patient is asymptomatic Repeat calcium level after 2 hours **If patient remains symptomatic or, if only temporary improvement, start a continuous IV calcium gluconate infusion:** Dilute 100 mL of calcium gluconate 10% in 1 litre of sodium chloride 0.9% or glucose 5% and give at an initial rate of 50 mL/hour adjusted according to response.

***Symptoms:**

- Peri-oral and peripheral paraesthesiae
- Positive Trousseau's and Chvostek's signs
- Tetany and carpopedal spasm
- Laryngospasm
- Hypotension
- Heart failure
- Seizure
- Irritability and confusion

****ECG changes in hypocalcaemia:**

- QTc prolongation
- Arrhythmia

Hyponatraemia (low sodium)

Hyponatraemia (Sodium <135 mmol/L) with severe or moderately severe symptoms*

Seek senior support and move patient to resus
Symptoms are unlikely if serum sodium >130 mmol/L – consider alternative diagnosis

Intravenous:

150 mL of 2.7% sodium chloride (hypertonic saline) over 20 mins

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Recheck serum sodium, do not wait for result

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Give a further 150 mL of 2.7% sodium chloride (hypertonic saline) over 20 mins while waiting for results

In the first hour repeat above steps twice **or** until rise in serum sodium of 5 mmol/L

Limit increase in serum sodium to 10 mmol/L in first 24 hours

Refer to full guidance for advice on management after the first hour

Measure urine osmolality and urine sodium

All patients need strict input/output monitoring – consider catheterisation
All patients need medication review to look for drug causes of hyponatraemia

***Symptoms of hyponatraemia**

Severe symptoms:

- vomiting
- cardiorespiratory arrest
- seizures
- reduced consciousness/coma (Glasgow Coma Scale ≤8)

Moderately severe symptoms:

- nausea without vomiting
- confusion
- headache