# Hypokalaemia, hyperkalaemia and hypomagnesaemia

## *Executive summary*

## Introduction

Abnormalities in serum potassium are relatively common in our admitted population, but can also be seen in outpatients. Abnormal K is a risk factor for sudden cardiac death and must be addressed whenever it is noted. Abnormal magnesium levels are less common and do not need to be actively sought out except in the presence of hypokalaemia, which will be difficult to correct in the presence of hypomagnesaemia.

Falsely high potassium levels are very common, usually resulting from errors in taking blood samples and handling the sample prior to analysis. Abnormal potassium levels must always be rechecked prior to treatment – although where the initial result is severe and consistent with the clinical state of the patient, treatment may be initiated prior to receiving the repeated result.

## Target users

* Doctors
* Nurses

## Target area of use

* Outpatient department
* Ward

## Key areas of focus / New additions / Changes

This guidelines addresses the correction of abnormal potassium and magnesium results.

Note that great care should be taken in correcting low potassium and magnesium levels in malnourished children as the supplements they are given already contain extra doses of these minerals. Senior support should be sought where the measured level is very low.

## Limitations

Patients requiring dialysis must be referred to the teaching hospital.

# Hypokalaemia

This defined as K < 3.5 mmol/l. Mild to moderate level is between 2.5 mmol/L and 3.4 mmol/L and severe hypokalaemia is defined as < 2.5 mmol/L

## Causes

* Enteral losses e.g. diarrhoea , vomiting
* Drugs e.g. insulin, theophylline, caffeine, salbutamol, loop and thiazide diuretics
* Metabolic alkalosis
* Malnutrition with refeeding
* Hypomagnesemia (it will be impossible to correct the hypokalaemia until the Mg level is treated)

## Presenting symptoms and signs

Patients are usually asymptomatic.

* Weakness
* Respiratory compromise
* Paralysis.
* ECG changes: T wave depression and inversion, ST Segment depression, U waves, cardiac depression

## Management

Always repeat the electrolytes to ensure the initial result is accurate. For severe hypokalaemia, start treatment before this result is available, but it must be reviewed immediately the repeat result is available.

Check serum magnesium and bicarbonate.

Withdraw medications that cause hypokalaemia.

Dietary supplementation with potassium – food for patients with mild hypokalaemia e.g bananas, oranges, green leafy vegetables, potatoes, cucumbers etc.

Note that F75 and F100 have extra potassium in them, so malnourished children with mild to moderate hypokalaemia do not need extra oral potassium supplements.

### Correction

Mild to moderate hypokalaemia may be treated with oral potassium supplements i.e Slow K at 1200 mg (16 mmol) BD or 10% of Potassium chloride solution given at 15 mls (20 mmol) 2-3 times daily. This dosage can be increased as needed. Monitor potassium every 48 hours.

Severe hypokalaemia is corrected with IV potassium chloride in normal saline infusion .

For patients with potassium level < 3.0 mmol/l give a total 60 – 80 mmol of Potassium chloride in 24 hours at 10 mmol/hr. Patients with potassium levels between 3.0 and 3.4 mmol/l and cannot take potassium enterally give 20 – 40 mmol/l intravenously and in infusion.

Avoid using dextrose containing fluid for infusion.

Monitor potassium levels every 2-6 hours.

# Hyperkalaemia

In children and adults, this is defined as potassium levels > 5.5 mmol/l. Mild hyperkalaemia is 5.5-5.9 mmol/L, moderate is 6.0-6.4 mmol/L and severe is ≥ 6.5 mmol/l. Severe hyperkalaemia is also present when serum potassium > 5.5mmol/L with ECG changes. Unless samples are haemolysed, all cases of hyperkalaemia should be treated immediately.

For infants aged 2 weeks to 3 months, hyperkalaemia is defined as K > 5.7 mmol/l.

For neonates aged less than 2 weeks, hyperkalaemia is defined as K > 6.0 mmol/l.

## Causes of hyperkalaemia

* Extracellular shift: metabolic acidosis, rhabdomyolysis
* Medications: succinylcholine, beta blockers and digoxin
* Reduced excretion- potassium sparing diuretics,renal failure

### Causes of pseudohyperkalaemia:

* Prolonged tourniquet time or repeated fist clenching
* Test tube haemolysis
* Sample contamination with potassium EDTA (anticoagulant)
* Delayed analysis (prolonged storage of blood)
* Marked leucocytosis and thrombocytosis (measure plasma not serum concentration in these disease states)
* Sample taken from a vein infused with IV fluids containing potassium (hospital setting)

These should be avoided when taking and analyzing samples. It should be kept in mind when reviewing laboratory results where there is high potassium level.

## Presenting symptoms and signs

Patients are usually asymptomatic.

* Muscle twitching
* Cramps
* Weakness and paralysis
* ECG changes: Peaked T waves, widened QRS complexes, Prolonged PR interval and prolonged QT interval
* Arrhythmias

Note that the absence of ECG changes does not exclude severe hyperkalaemia and does not mean that the patient cannot die suddenly of an arrhythmia.

## Management

All patients with hyperkalaemia should have an ECG done. Ideally they should be monitored during correction with an ECG**.**

Stop all supplements containing potassium and all potassium-containing IV fluids. Review drugs and consider stopping drugs which cause K retention.

For severe hyperkalaemia:

* IV 10 ml of 10% calcium gluconate in a central vein or slowly over 2-3 minutes
* IV 50 ml of 50% dextrose +10 units of soluble insulin over 10 minutes. In diabetes mellitus, if the blood sugar is raised, insulin should be given without glucose.
* Give nebulised salbutamol 10mg stat.
* Repeat potassium levels every one hour. If insulin is used, monitor blood sugar hourly too.

These measures all temporarily shift the serum potassium into the cells. To remove potassium from the patient’s system, consider if furosemide is an appropriate treatment.

If hyperkalaemia remains intractable, patient should be referred to the teaching hospital for dialysis.

For mild to moderate hyperkalaemia, restrict potassium in diet and review medications.

# Hypomagnaesemia

This is defined as serum magnesium levels less than 0.7 mmol/L. It is said to be severe if < 0.4 mmol/L.

## Causes

* Malnutrition
* Pancreatitis
* Diarrhoea
* Diuretics
* Sepsis
* Trauma
* Burn
* Alcoholism

## Presenting symptoms and signs

* Seizures
* Coma
* Weakness
* Cardiac arrythmias.

## Management

Mild to moderate hypomagnesaemia: IV Magnesium sulphate solution 2 g in 100 ml 0.9% saline over 2 hours.

Severe hypomagnesaemia: IV Magnesium sulphate solution 4 – 6 g in 250 mls of 0.9% saline over 4 hours (not exceeding 12 g per day).

## Key Issues for Nursing care

* Hypokalaemia and hyperkalaemia can both be associated with sudden cardiac death and must be treated.
* Follow the fluid instructions very carefully.
* Make sure repeat tests are done on time and are reviewed by a doctor promptly.
* All patients given insulin must have hourly bedside blood sugar monitoring.
* Seek senior support if you are at all concerned about the patient.

## References

Bartel B, Gau E. Fluid and Electrolyte Management. Critical Care Pharmacotherapeutics. Burlington, MA: Jones & Bartlett Learning. 2012 Feb 8:125-50.

Hoorn EJ, Tuut MK, Hoorntje SJ, van Saase JL, Zietse R, Geers AB. Dutch guideline for the management of electrolyte disorders-2012 revision. Neth J Med. 2013 Apr 1;71(3):153-65.

Kraft MD, Btaiche IF, Sacks GS, Kudsk KA. Treatment of electrolyte disorders in adult patients in the intensive care unit. American Journal of Health-System Pharmacy. 2005 Aug 15;62(16):1663-82.

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| **Written by:** | Name: Orighomisan Agboghoroma  Mariama Sonko | Date: 07 January 2019 |
| **Reviewed by:** | Name: Karen Forrest | Date: 09 May 2019 |
| **Version:** | **Change history:** | **Review due date:** |
| 1.0 | New document | 31 May 2021 |
| Review Comments (*if applicable)* |  |  |