Drug Guideline  Potassium Chloride

Approved by:  ICU Medical Director
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Replaces Existing Drug Guideline:  Potassium Chloride

Background Information:
Potassium is an essential body electrolyte found in intracellular fluid where it is the principal cation. It is essential for membrane potential stability.

1. Introduction:

Patient safety

The Aims / Expected Outcome of this drug guideline:

Potassium Chloride will be administered safely and appropriately without any adverse side effects

Related Standards or Legislation
- NSQHS Standard 1 Governance
- National Standard 4 Medication Safety

Related Policies
- LH_PD2013_C03.01  Drug Administration
- LH_PD2013_C03.03  Drug Calculation Formulas
- LH_PCP2016_C03.00  Drug Prescribing
- LH_PD2013_C03.12  Intravenous (IV) Therapy and Medication Administration

2. Drug Guideline: Policy Statement
- All care provided within Liverpool Hospital will be in accordance with infection control, manual handling and minimization and management of aggression guidelines.
- Medications are to be prescribed and signed by a medical officer/authorized nurse practitioner (NP) unless required during an emergency.
- All drugs administered during an emergency (under the direction of a medical officer/authorised nurse practitioner) are to be documented during the event, then prescribed and signed following the event.
• Medications are to be given at the time prescribed (as close to the time as is possible when multiple drugs require ‘same time’ administration and, when the nurse is caring for more than one patient, recognition is given to a possible short delay to administration – antibiotics and other lifesaving drugs are to be prioritised) and are to be signed by the administering nurse.

• Parenteral medication prescriptions and the drug are to be checked with a second registered or endorsed enrolled nurse prior to administration. The “rights of drug administration” must be followed: right: patient, drug, dose, route, administration, time, reason for the drug, documentation, education and evaluation/outcome.

• Adverse drug reactions are to be documented and reported to a medical officer.

• Medication errors are to be reported using the hospital electronic reporting system: IIMS.

• Guidelines are for adult patients unless otherwise stated

3. **Guideline**

**Actions**¹,²,³

- Potassium is the principal intracellular cation.
  - It is involved in cell function and metabolism.
  - It helps in the maintenance of intracellular acid/base balance and isotonicity.
  - It aids in transmission of nerve impulses, contraction of muscle and maintenance of renal function.
  - It is involved in the contraction of cardiac, skeletal and smooth muscle.
  - It is used in the treatment of life threatening arrhythmias due to hypokalemia.

**Indications**¹,³,⁴

- Prevention and treatment of potassium depletion in patients with hypokalemia.
- Treatment of digitalis toxicity.
- Persistent Ventricular Fibrillation (VF) due to documented or suspected hypokalemia. An administrated bolus of 5 mmol of potassium chloride (KCL) is given intravenously followed by close cardiac & serum electrolytes monitoring.⁴
- Treatment of the reversible cause (hypokalemia) for shockable (VF and VT) and non-shockable (asystole and PEA) rhythms.⁴

**Contraindications**¹

- Hyperkalemia of any aetiology.

**Precautions**¹,²,³

- Treatment of low potassium levels, particularly in patients with cardiac disease, renal disease or acidosis, requires close monitoring of acid-base balance, serum electrolytes, creatinine (and creatinine clearance in the elderly with renal failure) ECG and clinical status.
- If administering peripherally be cautious about the risk of extravasations. IV potassium chloride solutions can cause pain if given peripherally. This can be avoided by ensuring adequate dilution of potassium chloride solution.
- Renal impairment with oliguria or uraemia can cause increase in serum potassium level.
- Acute dehydration and heat cramps are common associating factors that may increase serum potassium levels.
- Where excretion of potassium may be an issue, concomitant administration of potassium may lead to hyperkalemia and cardiac arrest, especially if potassium is administered intravenously.
- Serum potassium levels should be monitored when treating hypokalemia in the presence of concomitant administration of potassium salts and a potassium sparing diuretic (e.g. spironolactone) or an ACE I inhibitor, since this can result in severe hyperkalaemia.
In patients on a low salt diet, or with gastric outlet obstruction or large NG losses, hypokalemic hypochloreaemic alkalosis may occur, requiring both chloride and potassium supplementation.

Potassium should be used with caution in diseases associated with heart block, since increased serum potassium may increase the degree of block.

Severe tissue breakdown including burns & rhabdomyolysis may precipitate an increase in serum potassium level as intracellular potassium ions shift out of the cells.

**Significant interactions**

- The following drugs are associated with either an increase or decrease in potassium levels, therefore caution is advised and concomitant use requires frequent measurement of potassium levels.
  - Adrenaline, amphotericin B, atropine, captopril, cephalothin, chloramphenicol, sodium succinate; chlorpromazine, diazepam; mannitol, phenytoin, suxamethonium, sulfadiazine sodium, thiopentone.
  - Insulin and Sodium Bicarbonate (decreases serum potassium).
  - Salbutamol administration by either iv or nebulizer can decrease serum potassium concentration.
  - Heparin may increase serum potassium level from the reduction of aldosterone synthesis.
  - ACE inhibitor including captopril elevates serum potassium by decreasing aldosterone secretion, possibly resulting in potassium retention.
  - Careful monitoring is extremely important if using potassium supplementation in digitalized patients with severe or complete heart block.

**Adverse effects**

The symptoms and signs of potassium intoxication include:

- Paraesthesiae of the extremities, flaccid paralysis.
- Nausea, vomiting, diarrhoea and abdominal discomfort.
- Listlessness, mental confusion, weakness and heaviness of the legs.
- Fall in blood pressure, cardiac dysrhythmias and heart block.
- Hyperkalemia may exhibit the following ECG abnormalities:
  - Tall peaked T waves, changes of the ST segment.
  - Disappearance of the P wave, widening and slurring of QRS complex, sine wave.
  - Ventricular tachycardia (VT), ventricular fibrillation (VF).

**Presentation**

Ampoule 10 mmol (0.75 g)/10mL (Potassium Chloride /KCL)
Administrations Guidelines\textsuperscript{1,2,3,6}
If being administered undiluted – it MUST BE given via central venous access device (CVAD).

For intravenous administration via CENTRAL VENOUS ACCESS DEVICE (CVAD) ONLY. This is administered via a syringe driver or using an in-line burette:

- The normal concentration of serum potassium is in the ranges of 3.5 – 5.2 mmol/L. Therefore the administrative dose for hypokalemia is dependent upon the individual patient's condition.
- Infuse using 0.9% sodium chloride solution, as glucose solutions decrease serum potassium concentrations.
- **Monitor ECG continuously.**
- The total dose should generally not exceed 200 mmol/24 hours or 20mmol/hr.
- If urgent treatment is required (serum potassium concentration less than 2 mmol/L with ECG changes or paralysis), infuse potassium at a rate of up to 40 mmol/hour, to a total of 400 mmol/24 hour period – with frequent serum potassium measurements and continuous ECG monitoring.
- Administer magnesium replacement, so that magnesium level is in the upper range of normal (>0.95 mmol/L).
- When administered via a CVAD; co-infusions must be checked for compatibility.
- For potassium replacements of 20 – 40mmol/hour, assess serum potassium levels hourly to 2\textsuperscript{nd} hourly.

**Draw up the prescribed amount of KCl neat in a 50ml syringe and load syringe driver, complete additive label, place on syringe and prime the line.** (eg: if prescribed dose is 30mmol, then draw up to a total concentration of 30mmol in 30ml)

<table>
<thead>
<tr>
<th>Serum potassium level (Normal 3.5 to 5.2 mmol/L)</th>
<th>Replacement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild 3.0 – 3.5 mmol/L</td>
<td>Administer 10mmol potassium over 1 hour. Dose can be continued at 10mmol per hour to maintain normal serum potassium levels (3.5 to 5.2 mmol/L) The dose is dependent on individual patient requirement.</td>
</tr>
<tr>
<td>Moderate 2.5 – 3.0 mmol/L</td>
<td>Administer 20mmol potassium over 1 hour. Dose can be continued at the rate of 10 to 20mmol over 1-2 hours depending on patient requirement, until K\textsubscript{+} &gt; 3.2mmol/L</td>
</tr>
<tr>
<td>Severe 2.0 – 2.5 mmol/L</td>
<td>Administer 20 to 30mmol potassium over 1 hour. Dose can be continued at 20 to 30mmol over 1-2 hours, regularly check serum potassium every 1 to 2 hours until K\textsubscript{+} &gt; 2.8mmol/L</td>
</tr>
<tr>
<td>Critical &lt; 2.0 mmol/L</td>
<td>Administer 30 to 40mmol potassium over 1 hour. Dose can be 30 to 40mmol over 1-2 hours, regularly check serum potassium every 1 to 2 hours until K\textsubscript{+} &gt; 2.8mmol/L Monitor closely for ECG changes, arrhythmias and paralysis due to severe hypokalemia.</td>
</tr>
</tbody>
</table>

Frequent checking of serum potassium levels is necessary during replacement.
Intravenous Administration via a peripheral line:
If KCL is administered peripherally, the drug is diluted in a minimum concentration of 40mmol in 1000mL.
Rate of administration will be dependent on patients potassium levels. In some ICU patients with peripheral access (large cubital fossa vein) maximum concentration for peripheral infusion is 10 mmol/100mL and maximum rate of administration for peripheral infusion is 10 mmol/hour²,⁷

Clinical Considerations²,³,⁴:
- Central access is utilised for concentrated solutions of potassium.
- Avoid extravasation as phlebitis, pain and tissue necrosis may occur, from high level of potassium chloride concentration in solution. Proper dilution of solution is paramount if administered peripherally.
- Consider obtaining prescription for oral/enteral potassium replacement in suitable patients with mild hypokalemia.
- Carefully check the potassium ampoule and do not store at bedside in close proximity to 0.9% sodium chloride ampoules. This is to avoid the risk of drug errors.
- Serum Potassium level > 5.5 – 6.5mmol/L (in patients with oligo/anuric renal failure potassium levels > 6.5 to 7.5 mmol/L) may induce cardiac arrhythmias or cardiac arrest. Urgent medical attention is required. In patients with chronic renal failure higher serum potassium levels may be acceptable.

Treatment of Hyperkalaemia³,⁴:
- Discontinue potassium administration immediately.
- Eliminate foods and medications containing potassium and cease potassium sparing diuretics.
- Volume depletion should be corrected - Early aggressive rehydration with 0.9% sodium chloride.

Emergency treatment of hyperkalaemia¹,²:
- Intravenous insulin and glucose - 50mL of 50% glucose with 10 units actrapid insulin in a syringe, given IV over 10 - 15 minutes. Monitor BGL after 15minutes, then 30 minutes, then hourly till stable.
- Intravenous bicarbonate is effective if metabolic acidosis is present – Sodium bicarbonate (8.4%, 1mmol/ml) 50ml IV over 5 to 10minutes.
- IV calcium gluconate 10% 10mL as a bolus injection over 2-3minutes or IV calcium chloride 10% 10mL as a bolus. The dose can be repeated after 5 minutes if ECG changes persist or recur (Calcium alleviates the membrane depolarization of severe hyperkalemia and has a cardiac stabilizing effect).
- Beta₂-adrenergic agonists that promote tissue uptake of potassium, can be used in hyperkalemia caused by renal failure.
  - Salbutamol 0.25 to 0.5mg intravenously.
  - Salbutamol 10mg by nebulizer (over 10 minutes). Decreases serum potassium by 0.5 -1.5mmol/L in 30 to 90 minutes.
- Calcium resonium aids in removal of potassium from the bowel. Orally -15g (suspended in 45 to 60ml H₂O); Rectally – 30g (suspended in 150ml H₂O).
- If olyuric/anuric and rehydrated, institute early CRRT.

4. Performance Measures

All incidents are documented using the hospital electronic reporting system: IIMS and managed appropriately by the NUM and staff as directed.
5. References / Links

6. SWSLHN_GL2011_001, Potassium Guidelines, SWLHD.

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