Ballarat Health Services

DRUG GUIDELINE

POTASSIUM - intravenous infusion and enteral (ICU, ED, Theatre and CVS)

HIGH RISK MEDICATION

SCOPE (Area): **FOR USE IN:** Intensive Care Unit, ED, Theatre and CVS
EXCLUSIONS: General Wards and Coronary Care Unit
SCOPE (Staff): Medical, Nursing and Pharmacy

Intravenous injection of concentrated potassium can cause fatal cardiac arrhythmias. As such intravenous injections of potassium (chloride only) may be given only during cardiac arrest, via a peripheral line, according to ARC (Australian Resuscitation Council) Guidelines and are not covered in this guideline. Potassium chloride ampoules required for resuscitation situations must be stored in red/orange bags (supplied by Pharmacy) that are clearly labelled for this use.

Potassium use in diabetic ketoacidosis management is complex and not covered in this guideline - see CPP0540 Management of Diabetic Ketoacidosis.

Potassium supplementation in Haemodialysis (see CPP0414 Dialysis Procedures/Processes) and Haemofiltration (see CPP0415 Haemofiltration - Prismaflex) are not covered in this guideline.

For General Ward patients see Potassium - intravenous infusion and enteral (General Wards and Coronary Care Unit) DRG0043.

BRAND NAMES

See table of potassium preparations available under Dosage and Administration.

PHARMACOLOGY AND PHARMACOKINETICS

Potassium ion is the principal intracellular ion of most body tissues, being involved in a number of essential processes, including maintenance of intracellular tonicity, nerve impulse transmission, contraction of cardiac, skeletal and smooth muscle, and maintenance of normal renal function. Enteral potassium is usually well absorbed from the gastrointestinal tract (sustained release potassium releases slowly over 3-4 hours). Potassium is predominantly excreted by the kidneys.

INDICATIONS

- For the treatment or prevention of hypokalaemia.

CONTRAINDICATIONS

- **Hyperkalaemia.**

PRECAUTIONS

- **Renal impairment with oliguria or azotaemia.**
- **Ventricular fibrillation.**
- **Extensive tissue breakdown** (e.g. severe burns).
- **Hyperadrenalism associated with adrenogenital syndrome.**
- **Acute dehydration or heat cramps.**
- **Chronic renal disease, adrenal insufficiency or any other condition which impairs potassium excretion** - requires particularly careful monitoring of the serum potassium concentration and appropriate dosage adjustment.
- **Cardiac disease, heart block or acidosis** - requires careful attention to acid/base balance and appropriate monitoring of serum electrolytes, the ECG and the patient's clinical status.
- **For sustained release oral potassium only:**
  - **All conditions in which passage through the digestive tract is retarded or obstructed** (e.g. compression of the oesophagus, gastrointestinal stenosis or atony).
  - **Acute peptic ulcer or gastritis.**
  - **Patients with ostomies** - may have an altered intestinal transit time and are better treated with soluble potassium.

PREGNANCY AND BREASTFEEDING

Seek specialist advice before prescribing, information may update regularly.

PAEDIATRICS & NEONATAL

For paediatric and neonatal patients refer to a Paediatric reference or the Paediatric team for dosing information. Refer to the Paediatric Injectable Guideline for information regarding administration.

DRUG INTERACTIONS

- **Drugs that increase potassium levels (e.g. ACE inhibitors, spironolactone, potassium sparing diuretics)** - increased risk of hyperkalaemia with potassium administration. Monitor potassium levels.
- **NSAIDs** - increased risk of hyperkalaemia (as well as reducing renal function further increasing the risk of hyperkalaemia) with potassium administration. Monitor potassium levels and serum creatinine.
- **Anticholinergics** (with oral sustained release potassium only) - may reduce gastrointestinal motility increasing the risk of gastrointestinal ulceration or perforation (see Contraindications).

DOSAGE AND ADMINISTRATION

Information for prescribing and administering potassium (ICU, ED, THEATRE and CVS):

1.) Important safety information regarding INTRAVENOUS infusion use

- **Potassium is a high risk medication. It is only to be administered by intravenous infusion - ampoules are concentrated and rapid intravenous administration can result in serious patient outcomes, including death.**
- **Premixed potassium chloride solutions are to be used whenever possible.**
- **Potassium chloride ampoules are only kept on imprest in the Intensive Care Unit and the Emergency Department and NOT to be supplied to any other areas of the hospital. On imprest they must be kept in a clearly labelled container and separated from similar looking ampoules (e.g. water for injection).**
- **Potassium chloride ampoules are only to be used in the following circumstances:**
  - **for adding to haemofiltration fluid when Phoxilium is not appropriate for use**

(Intensive Care Unit only)
  - **for preparing paediatric DKA fluids requiring potassium (not covered by this guideline)**
- **In the rare circumstances (e.g. hyperchloraemia) other salts of potassium (potassium acetate OR potassium dihydrogen phosphate and dipotassium hydrogen phosphate) may be required. These salts of potassium must be approved by the Specialist/Consultant responsible for the patient, with the inpatient order including the name of the consultant giving approval. These intravenous infusion solutions will be prepared by the Pharmacy. Ampoules are NOT to be supplied to any wards.**
- **Careful monitoring of the serum potassium level is advised, during intravenous administration, as hyperkalaemia and cardiac arrhythmias can occur quickly and without apparent warning, especially with too rapid administration, impaired renal function or other electrolyte disturbances.**
- **Intravenous potassium infusions may cause pain if given peripherally via a small vein, use a large vein or central line wherever possible.**
- **Maximum rate of potassium administration via peripheral line is 10 mmol/hour.**
- **Maximum concentration for potassium administration via peripheral line is 10 mmol/100 mL or 30 mmol/1000 mL (using premixed solutions).**
- **Potassium rates greater than 10 mmol/hr require a central line, ECG monitoring, frequent serum potassium measurements (2 hourly recommended), and regular assessment of renal function.**
- **Maximum usual dose of potassium for administration via peripheral or central line is 90 mmol/24 hours. Doses above this require Specialist/Consultant advice and documentation of this advice by Medical Staff in the medical record.**
- **Usual rate of potassium administration via central line is 10 mmol/hour. Maximum rate of potassium administration via central line is 30 mmol/hour. Rates exceeding 30 mmol/hour may be appropriate for selected patients at the discretion of the treating Consultant. (Note: iatrogenic hyperkalaemia may be detected by tall peaked T waves).**
- **Maximum concentration for potassium administration via central line is 40 mmol/100 mL (using the premixed hypertonic solution) or 30 mmol/1000 mL (variety of premixed bags).**
- If potassium concentrations are outside the **therapeutic range (3.5-5.0 mmol/ L),** patients treated with intravenous potassium will usually require at least daily monitoring of serum potassium levels. Those receiving higher doses will require more frequent monitoring as per the Dosage table (e.g. serum potassium should be rechecked 30-60 minutes following the administration of 20 mmol or greater of potassium), or at the discretion of the treating clinician.

2.) Information for Prescribers

- **Patients with complex alterations in electrolyte balance, acid base status, renal function or disturbance of other components of plasma will require individualised care. This guideline may not be appropriate in such cases.**
- **Prescribe premixed bags (or consultant approved & pharmacy prepared potassium solutions) for intravenous infusion wherever possible. Only prescribe the addition of potassium chloride ampoules to solutions in the circumstances described above under point 1.**
- Consider ongoing potassium losses (e.g. from diarrhoea, stoma and drain sites) when determining replacement therapy.
- In treatment resistant hypokalaemia, ensure serum magnesium is checked and corrected if necessary.
- Potassium is to be prescribed enterally wherever possible unless clinically inappropriate (e.g. severe hypokalaemia, unable to tolerate enteral potassium).
- Intravenous potassium must be prescribed in millimoles (mmol) of potassium and include

the salt required (not abbreviated e.g. write potassium chloride), diluent, volume and duration/rate of infusion.

- When calculating the dose of potassium required by a patient take into account other sources of potassium (e.g. intravenous phosphate also has potassium).
- See tables below for information regarding dosing information and potassium preparations available. The doses apply to the amount of potassium in mmol, regardless of the salt used.

3.) Information for Nursing staff

- **Caution: Extravasation may cause severe complications - check any peripheral line with potassium running carefully. Pain or phlebitis may occur during administration of potassium solutions. Check any lines immediately if the patient complains of pain. Phlebitis can be minimised by using a large vein and reducing the rate or the concentration - contact the Prescriber if an issue. Change to enteral potassium where appropriate. Lignocaine is not be added to an intravenous potassium solution, as it will only mask the underlying phlebitis. Note: Intensive Care Unit and the Emergency Department have both potassium chloride 40 mmol/100 mL minibags (central line use only) and 10 mmol/100 mL minibags (central or peripheral line) - phlebitis should raise the suspicion that the 40 mmol in 100mL minibag may have been hung inadvertently.**
- **Use premixed bags or Pharmacy prepared potassium solutions for intravenous infusion wherever possible. Only add potassium chloride ampoules to solutions in the circumstances described above under point 1. Potassium is not to be added to burettes.**
- **Potassium chloride 40 mmol/100 mL minibags are only to be stocked in the Intensive Care Unit and the Emergency Department in a clearly labelled container, separated from potassium chloride 10 mmol/100 mL minibags and marked 'central line use only'.**
- **Potassium chloride ampoules:**
  - **Ampoules must be stored in clearly labelled containers, in one central imprest location and must be physically separated from ampoules containing water or normal saline.**
  - **Where potassium solutions are prepared using potassium ampoules, the ampoules must be diluted and the solution inverted at least 10 times to ensure that potassium is thoroughly mixed throughout the solution.**
- Nothing is to be added to premixed potassium chloride bags.
- An Alaris PC infusion pump with Guardrails must be used to administer potassium containing solutions to ensure inadvertent larger doses are not administered.
- If a patient receiving sustained release potassium tablets develops pronounced nausea, severe vomiting, severe abdominal pains or flatulence, diarrhoea or gastrointestinal haemorrhage, contact the Prescriber as these signs and symptoms may indicate ulceration or perforation in the gastrointestinal tract (see Adverse Effects).

Enteral potassium preparations available in ICU, ED, Theatre and CVS		
Generic name and form	**Brand name**	**Amount of potassium**
Potassium chloride 600 mg SR tablet*	Slow K®, Span K®, Duro K®	8 mmol per tablet
Potassium (chloride and other salts) effervescent tablet	Chlorvescent®	14 mmol per tablet

*SR tablets release slowly over 3-4 hours and are not usually appropriate for acute hypokalaemia

Intravenous potassium preparations available in ICU, ED, Theatre and CVS	
Premixed potassium chloride bags - red outer packaging with red print. Further potassium is not to be added to these bags. Paediatric premixed formulations are not included in this list.	**Amount of potassium**
Potassium chloride 10 mmol in 100 mL sodium chloride 0.29% minibag. Isotonic.	10 mmol in 100 mL
Potassium chloride 40 mmol in 100 mL sodium chloride 0.9% minibag. Hypertonic. For Central Line use only in Intensive Care Unit.	40 mmol in 100 mL
Potassium chloride 30 mmol in 1000 mL sodium chloride 0.9% bag. Hypertonic.	30 mmol in 1000 mL
Potassium chloride 30 mmol in 1000 mL glucose 4% and sodium chloride 0.18% bag. Isotonic.	30 mmol in 1000 mL
Potassium chloride 30 mmol in 1000 mL glucose 5% bag. Isotonic.	30 mmol in 1000 mL
Potassium chloride 30 mmol in 1000 mL in Hartmann's bag. Isotonic.	30 mmol in 1000 mL
Undiluted potassium ampoules - must dilute before use, and only as described under Dosage and Administration	**Amount of potassium**
Potassium chloride (concentrated) 10 mmol in 10 mL water for injection. Hypertonic. 10 mmol potassium = 0.75 g potassium chloride	10 mmol per 10 mL amp (requires dilution)
Potassium bags available prepared by Pharmacy. Further potassium is not to be added to these bags.	**Amount of potassium**
Potassium acetate bags. (Reserved for potassium supplementation in patients with hyperchloraemia or metabolic acidosis).	10 mmol added to 250 mL compatible fluid 25 mmol added to 1000 mL compatible fluid CVC only: 10 mmol added to 100 mL compatible fluid 25 mmol added to 100 mL compatible fluid
Potassium dihydrogen phosphate and dipotassium hydrogen phosphate bags. (Reserved for potassium supplementation in patients with hyperchloraemia or metabolic acidosis. Doses will need phosphate content taken into account, and may require adjustment.)	10 mmol added to 250 mL compatible fluid 25 mmol added to 1000 mL compatible fluid CVC only: 10 mmol added to 100 mL compatible fluid 25 mmol added to 100 mL compatible fluid

SUGGESTED POTASSIUM (ANY SALT) DOSES

These dosage recommendations are based on the needs of a patient weighing 70 kg, who is not already receiving potassium supplements and who has normal renal function and acid base status except where stated.
Treatment should be individualised for each patient's situation, with any deviation from these guidelines approved by the treating medical specialist. See above for maximum hourly and 24 hourly doses.
All intravenous doses use premixed bags or bags prepared by the Pharmacy.

	POTASSIUM LEVEL		
Patient type	**Moderate-severe hypokalaemia (less than 3 mmol/L)**	**Mild hypokalaemia (3.0-3.5 mmol/L)**	**Low normal (3.5-4.0 mmol/ L)**
Maintenance intravenous infusion therapy	**Intravenous infusion** 5-10 mmol potassium/hour[1]	**Intravenous infusion** 90 mmol potassium/24 hours given in divided doses using premixed or Pharmacy prepared bags (Close Monitoring of potassium levels recommended)	**Intravenous infusion** 60 mmol potassium/24 hours given in divided doses using premixed or Pharmacy prepared bags (Close Monitoring of potassium levels recommended)
Acute coronary syndrome (Patients may require telemetry)	**Intravenous infusion** 10 mmol potassium/hour[1] **and enteral** 1-2 effervescent tablets (14-28 mmol potassium) stat – as a single dose. Dissolve in water and take after food.	**Enteral** 1-2 effervescent tablets (14-28 mmol potassium) stat – as a single dose. Dissolve in water and take after food.	
Life threatening hypokalaemia	**Intravenous infusion** 20-40 mmol potassium/hour[2]		
Surgical Pre-op elective on planned day of surgery	Consider deferring surgery	**Enteral** 1-2 effervescent tablets (14-28 mmol potassium) stat -as a single dose Dissolve in water and take after food. (Must be approved by Anaesthetist if within 4 hours of planned surgery)	
Surgical Pre-op emergency	**Intravenous infusion** 10 mmol potassium/hour depending on circumstances	**Intravenous infusion** 10 mmol potassium/hour	
Diabetic ketoacidosis	This is an extremely complex area, and expert advice and management in ED or ICU is almost always required. See CPP0540 Management of Diabetic Ketoacidosis.		
Renal impairment	Extreme caution is required, as these patients are prone to severe, life-threatening hyperkalaemia.		

[1]10 mmol potassium/hour for 2 hours is usually sufficient, however potassium levels should be monitored, and requirements for further maintenance doses assessed at the end of that time.
[2] Cardiac monitoring, frequent serum potassium levels and renal function assessment are indicated in addition to strict fluid balance monitoring with infusion rates greater than 10 mmol potassium/hour.

General Administration Information

- **Infusion preparation:** Use premixed or Pharmacy prepared bags except where outlined above.
- **Infusion pump:** Alaris PC smart pump with Guardrails
- **Routes of administration:**
  IV injection: Only in cardiac arrest according to ARC Guidelines
  IV intermittent infusion: Yes
  IV continuous infusion: Yes
  IM injection: No
  Subcut injection: No
- **Compatible/incompatible IV drugs/fluids:**
  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)

- See 'Information for prescribing and administering potassium' under Dosage and Administration.

NURSING PRACTICE POINTS

- See 'Information for prescribing and administering potassium' under Dosage and Administration.

ADVERSE EFFECTS

- **Hyperkalaemia** - caused by excessive potassium supplementation. Signs and symptoms include hypotension, cardiac abnormalities (arrhythmias, heart block, disappearance of the P wave, widening and slurring of QRS complex, changes of the ST segment, tall peaked T waves), nausea, vomiting, diarrhoea and abdominal discomfort, paraesthesias of the extremities, flaccid paralysis, listlessness, mental confusion, weakness and heaviness of the legs.
- Intravenous administration: Pain or phlebitis may with potassium salts given peripherally.
- Oral administration (sustained release):
  - Common - nausea, vomiting, diarrhoea and abdominal discomfort. These side effects occur more frequently when the medication is not taken with food.
  - Rare - gastrointestinal bleeding, obstruction or ulceration.
- Enteral administration (effervescent):
  - Common - nausea, vomiting, diarrhoea and abdominal discomfort. These side effects occur more frequently when the medication is not taken with food or if effervescent potassium is not diluted properly or dissolved completely.

DRUG PRESENTATIONS AND STORAGE

Potassium chloride 10 mmol in 10mL ampoules - See Appendix TWO for areas which may stock potassium chloride ampoules within their met trolley/bag.
Potassium chloride premixed bags - multiple premixed bags as described above.
Potassium acetate bags - prepared by Pharmacy only.
Potassium dihydrogen phosphate and dipotassium hydrogen phosphate bags- prepared by Pharmacy only.
Store below 25°C.

RELATED DOCUMENTS

Internal

SOP0001	Clinical Care.
DRG0044	Potassium - intravenous infusion and enteral (General Wards).
CPP0222	Labelling of Injectable Medicines and Lines.
CPP0414	Dialysis Procedures/Processes
CPP0415	Haemofiltration - Prismaflex
CPP0509	Hyperkalaemia Management
CPP0540	Management of Diabetic Ketoacidosis
CPP0549	High Risk Medications

External

High Risk Medication Alert - Intravenous Potassium Chloride. From the Medication Safety Taskforce of the Australian Council for Safety and Quality in Health Care. Available at http://www.safetyandquality.gov.au/our-work/medication-safety/medication-alerts/intravenous-potassium-chloride/

REFERENCES

- Alfred Health (2010, November). *Safe use of Potassium Chloride (KCl)- Oral and Intravenous.* Alfred Health.
- Barwon Health (2011, February). *Potassium Administration - General Wards.* Barwon Health.
- Southern Health (2011, July). *Potassium Adult Medication Profile.* Southern Health.
- The Northern Hospital (2011, September). *Potassium Chloride Drug Protocol.* The Northern Hospital.
- Victorian Medication Safety Committee (2005, January). *Victorian Guideline for Replacement of Potassium.* Retrieved October 19, 2013, from http://www.victag.org.au/?pv_document=victorian-guideline-for-the-replacement-of-potassium.
- Rossi, S. (2013, July). *Australian Medicines Handbook*. Retrieved September 4, 2013, from http://www.amh.net.au/online/view.php.
- Therapeutic Guidelines Limited. (2009, June). *Endocrinology Guideline*. Retrieved September 4, 2013, from http://online.tg.org.au/ip/.
- UBM Medica. (2013, September). *MIMS Online, Potassium Chloride Concentrate product information.* Retrieved September 4, 2013, from https://www.mimsonline.com.au/Search/Search.aspx.
- UBM Medica. (2013, September). *MIMS Online, Potassium Chloride SR tablet product information.* Retrieved September 4, 2013, from https://www.mimsonline.com.au/Search/Search.aspx.
- UBM Medica. (2013, September). *MIMS Online, Chlorvescent® product information.* Retrieved September 4, 2013, from https://www.mimsonline.com.au/Search/Search.aspx.
- The Society of Hospital Pharmacists of Australia. 2011. *Australian Injectable Drugs Handbook* (5th ed.). Collingwood: The Society of Hospital Pharmacists of Australia.
- Thomson Reuters. (2013). *Micromedex 2.0*. Retrieved September 4, 2013, from http://www.micromedexsolutions.com/micromedex2/librarian .
- UpToDate, Inc. (2013) *UpToDate, Drug Interaction section*. Retrieved September 4, 2013, from http://www.uptodate.com/contents/search.
