Safe prescribing of intravenous Potassium and other Electrolytes

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Based on NSW Health Policy Directive PD2012_003 "High Risk Medicines Management". This is a basic reference tool for the prescribing, administration and monitoring of high risk medicines. Links to further information available on the local intranet site by typing in key words or reference codes on page 1 & 2. This list of medicines and information is not exhaustive

Penicillins - ampicilin, amoxydilin (alone or in Augmentin[®]), berzytpenicilin, fludoxacilin, dicloxacilin, phenoxymethytpenicilin, piperadilin (in Tazocin[®]), ticarcilin (in Timentin[®]) Is it a penicillin? S.W.LM . Vol.8 (2) Nov 2013

FURTHER INFORMATION Guidance M5.*

Glycopeptide- vencomycin WSYD-GL201266 Guide to Vencomycin Use in Adult Hospital Inpetients V2.0

Aminoglycosides: emikacin, gentemicin, tobremycin: WSYD-GL201266 Aminoglycosides in Hospital Adult In-Padients V1.0

Liposomal amphotericin B - aiso known as amphotericin B. (liposomal) or AmBisome®

ABCs of Antibiotics Intranet Page



POTASSIUM & OTHER ELECTROLYTES

Potassium IV: Incorrect administration or inadvertent overdose can cause death from life-threatening cardiac arrhythmias

potassium chloride, potassium dihydrogen phosphate, potassium acetate

sodium dihydrogen phosphate WSYD-POLY202031 Phosphate Administration in Adults

magnesium sulphate PURTHER ADMINISTRATION GUIDES Refer to SHPA Injectable Druge Handbook

calcium gluconate

INSULIN

rapid-acting: NovoRapid[®], Humalog[®], Apidra[®] chort-acting: Actrapid[®], Humulin R[®] Hypurin Neutral[®] Intermediate-acting: Humulin NPH[®], Protaphane[®], Hypurin Isophane®

long-aoting: Levernir®, Lantus® biphasio: Novomix 30⁸, Humalog Mix25⁸, Humalog Mix 50⁸, Mixtard 30/70⁸, Humulin 30/70⁸, Mixtard 50/50⁸

UIDELINES ON ADULT SUBCUTANEOUS INSULI ALGORITHM FOR INSULIN ADJUSTMENTS - Routi Insulin/glucose infusions in adults SWHR-2733 INSULINGLUCOSE INFUSION: Nursing Manage W8YD-PROC200934

INSULIN: Safe Use in Hospitals with Adult Patients with Diabetes WSYD- PROC200935



NARCOTICS & OTHER SEDATIVES hydromorphone (immediate release: Discudo*: slow release: Jurnista*)

oxycodone (immediate release: OxyNorm^a, Endone^a; slow release: Oxycontin^a or Targin^a (combined with nelocone)

morphine WSYD-PROCZ01287, WSYD-GL200981, WSYD-PROCZ01283
fentanyl, remfentani and analysisic patches WSYD-PROCZ01888
buprenorphine, ketamine, methadone WSYD-PROCZ01882, WSYD-PROCZ01275

benzodiazepines, e.g. alprazolam, clonazepam, diazepam, lorazepam, midazolam, temazepam Control Pain Term

thiopentone, propofol and other short term anaesthetics

vinoa alkaloids: vincristine, vinbiastine, vinoreibine

CHEMOTHERAPEUTIC (CYTOTOXIC/ANTINEOPLASTIC) AGENTS

Examples: azathioprine methotrexate

CYTOTOXIC PROCEDURES & GUIDELINES NSW Cancer institute Guidelines www.svq.org.au NSW WORNCOVER Cylor Drugs and Related Waste Rick Management Guide COSA Guidelines for Safe Prescribing, Dispanaing & Administration of Cancer Chemotherasy



HEPARIN AND ANTICOAGULANTS WSYD-GL201270 Guidelines for Anticoagulation (Adult) V9.13

Warfarin (Cournedin® or Marevan®), a vitamin K antagonist

Newer oral anticoagulants (NOACs), non vitamin k antagonists : rivaroxaban (Xareto*), dabigatran (Predexa*), apixaban (Eliquis*)

Parenteral Anticoagulants

Low molecular weight heparins: Enoxaparin (Clexane*), dalteparin (Fragmin*), fondaparinux (Aristre*) unfractionated heparin

danaparoid

MEDICATION SAFETY SYSTEMS

- Best Possible Medication History (BPMH) within 24 hours of admission to hospital
- Medicines Reconciliation BPMH vs NIMC and document differences in Medication Management Plan (MMP) within 24 hours of admission
- Allergies and adverse drug reaction (ADR) reporting on NIMC
- Pharmaceutical Review- Contact your ward pharmacist or the Department of Pharmacy

Fatal or serious incidents related to IV Potassium

- Potassium chloride ampoule selected instead of Sodium chloride 0.9% 10mL to flush cannula → patient died
- 2. Potassium chloride ampoule selected instead of WFI to reconstitute a medication for IV admin near miss
 - Error of substitution
 - ➤ System remedy removed Potassium concentrated amps from general wards & only allow pre-mixed infusion bags.
 - Store Potassium amps away from other look alike amps (e.g. N/S, WFI)





- 3. Potassium chloride 10mL given as a bolus
 - patient died
 - Never write "stat" or "bolus" for an IV potassium order
 - Always specify the diluent type, volume, and infusion rate in mL/hr

- 4. Potassium chloride added to a running fluid infusion → cardiac arrest
 - ➤ Do NOT add potassium into a running infusion.
 - ➤ Use premixed bags
 - If potassium needs to be added into a **new** IV fluid bag, invert the bag multiple time to ensure the solution is thoroughly mixed.





- 5. Several litres of IV fluids containing KCl given to a patient requiring fluid resus → hyperkalaemia, patient fatality
- Avoid bolusing IV fluids that contains potassium
- Hartmann's & PlasmaLyte 148 replacement contains potassium 5mmol/L
- 6. Inadvertent infusion of KCl via an epidural catheter (KCl mistaken for N/S to dilute anaesthetic)
- 7. Other cases
- KCL 40mmol IV bolus given instead of Frusemide 40mg →death
- Potassium phosphate injection used instead of heparin to flush a central line → death
- 10month old girl post ASD surgery, **died** due to hyperK, source of exogenous K unknown
- Incorrect preparation of potassium solution by pharmacy infused into a 6month old infant
 → death
- Concentrated KCL syringe given to mother of a child dependent on home TPN. KCL was meant to be injected into the TPN bag before infusion. But mother injected the KCl directly into the central line, child died.

IV Potassium prescribing

Maximum concentration:

via a peripheral line = 30mmol/L

Maximum Infusion rate:

with no cardiac monitoring = 10mmol/hour

Potassium Products available:

Intravenous

Pre-mixed bags for peripheral line:

- Potassium chloride 30mmol in Sodium chloride 0.9% 1L
- Potassium chloride 30mmol in Glucose 4% + Sodium chloride 0.18% 1L
- Pøtassium chloride 30mmol in Glucose 5% 1L

Potassium chloride 10mmol in Sodium Chloride 0.29% 100mL (isotonic)

 This bags is better tolerated (less pain) when infused over 2 hours (ie 50mL/hr)

Oral

- Potassium chloride SR = 8mmol per tablet
- Chlorvescent ® = 14mmol per tablet
- Large doses → N/V





Potassium replacement requirements

Mrs RL

39yo F, 70kg

Acute exacerbation of Ulcerative Colitis

Diarrhoea 10-15x/day, NBM/CF, IV fluids (no electrolytes added)

Day 9 of admission: Potassium level 2.4mmol/L

Prescribe potassium replacement ->

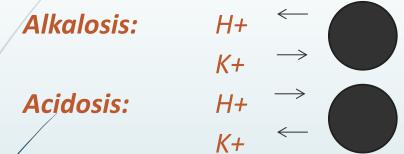
Potassium deficit

- •Total body K content of a **70kg** person = 4000mmol
- •Intracellular concentration: 140mmol/L
- •Extracellular concentration: 3 5mmol/L (2% of total body K)
- In the absence of factors affecting IC:EC ratio of potassium, total body deficit of potassium is approx 100mmol for every 0.5mmol/L reduction in serum potassium below [K] 4.2mmol/L.
 - •Serum [K] 3mmol/L = total body deficit approx 230mmol
 - •Serum [K] 2.5mmol/L = total body deficit approx 330mmol
- Replace deficit over a few days
- Check time of infusion w.r.t blood test

Factors that cause hypokalaemia:

1. Apparent deficit – intracellular shifting of potassium:

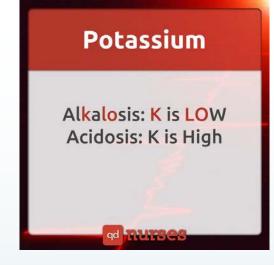
Metabolic alkalosis, beta2-adrenergic agonists (Salbutamol), Insulin



(Correction of acidosis → decrease [K])

- 2. Abnormal losses diarrhea, high fistula/stoma outputs, medications
- Inadequate supplementation (NBM & no routine IV replacement)

Daily requirement of potassium: 1 – 2mmol/kg/day



<u>Safe Handling of Intravenous Potassium Chloride and Other Concentrated Potassium Salts (Adult) -</u>

Key points for safe prescribing:

oOral potassium is safer than IV

oPrescribe pre-mixed bags

oClearly specify dose (in mmol), diluent type and volume, infusion rate

oMaximum infusion rate 10mmol/hour

oMaximum concentration via peripheral line 30 mmol/L

o(except for the KCI 10mmol in NaCl 0.29% 100mL isotonic bag)

oNever write "stat" or "bolus" for an IV potassium order

<u>Magnesium</u>

- **■General requirements:** 10 20mmol/day
- **■**Intravenous products:
 - Magnesium Sulfate 10mmol/5mL
- **Concentration**: 10mmol /100mL
- ■Infusion rate: 10mmol / hour







Calcium

Intravenous preparations:

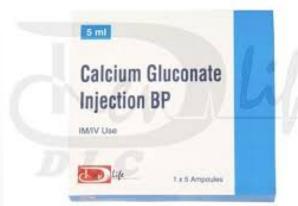
- Calcium gluconate 2.2mmol/10mL
 - = 10% = 1g/10mL
- Calcium chloride 6.8mmol/10mL
 - = 10% = 1g/10mL

Concentration: 2.2mmol /100mL

Infusion rate: 2.2mmol / hour

Compatibility:

- **Compatible** with Sodium chloride 0.9%, Glucose 5%, Hartmann's
- NOT compatible with fat emulsions, blood products, IV fluids containing phosphates, magnesium sulfate, bicarbonate, citrate salts.



Phosphate Administration in Adults (WSLHD policy online)

- General requirements: 20 40 mmol / day
- Intravenous products:
 - Potassium dihydrogen phosphate 10mmol / 10mL
 - **■**Sodium dihydrogen phosphate 10mmol / 10mL
- **Concentration:** max 40mmol/L
- Infusion rate: max 10mmol / hour

Compatibility:

■NOT compatible with IV fluids containing calcium and magnesium (e.g. Hartmann's, Plasmalyte-148 replacement)

Examples of IV electrolyte orders

Dat	e Indication	Fluid Type	Volume (mL)	Additive and Amount	Rate (mL/hr)	Route	Prescriber's Name Print & Signature/pager No.	
1/2/	9 Maintenance	Glucose 4% +	1000 mL	Potassium Chloride	80	IV	Dr Anne Jones	
		Sodium Chloride 0.18%		30 mmol			A Jones	12345
1/2/	9 Hypokalaemia	Sodium Chloride	100 mL	Potassium Chloride	100	IV	Dr Anne Jones	
		0.29%		10 mmol			A Jones	12345
1/2/		Sodium Chloride	1000 mL	Potassium	60	IV	Dr Anne Jones	
	temia	0.9%		Dihydrogen			A Jones	12345
				Phosphate 30 mmol				
2/2/	J 1	Sodium Chloride	100 mL	Magnesium sulfate	50	IV	Dr Anne Jones	
	emia	0.9%		10mmol			A Jones	12345
2/2/	1	Sodium Chloride	100 mL	Calcium Gluconate	100	IV	Dr Anne Jones	
	caemia	0.9%		2.2mmol			A Jones	12345