Electrolyte Replacement Therapies

Potassium (1 mmol = 1 mEq K^+)

Salt	Form	Strength	Elemental K^+
Potassium Chloride	Tablet	600 mg	8 mmol
	Tablet	1500 mg	20 mmol
	Liquid	1500 mg/15 mL	20 mmol/15mL
	Injection	See Table below	
Potassium Citrate	Effervescent tablet	2.5 g	25 mmol

Prevention and Treatment of Hypokalemia

Status			Dosage
Preventative Therapy			20-40 mmol/day po
Treatment K^+ = 2.5-3.5 mmol/L asymptomatic patient			40-100 mmol/day po in divided doses. Check serum K^+ levels daily.
K^+ < 2.5 ***OR*** K+ 2.5–3.0 mmol/L **WITH** symptoms (e.g. cardiac arrhythmias or conduction disturbances, respiratory muscle weakness, paralysis)	IV intermittent	General nursing units	20 mmol/50mL centrally OR 20 mmol/250mL peripherally administered over 1 hr
		Critical/ special care	40 mmol100mL centrally over 1 hr ECG monitoring required for rates greater than 20 mmol/hour
	IV infusion	Peripheral line	Usual 20-40 mmol/L (max 80 mmol/L) infused at max rate of 10 mmol/hr
		Central line	Usual 20-60 mmol/L infused at max rate of 20 mmol/hr

Notes:
1. Administer supplements cautiously in patients with renal impairment and those on potassium sparing diuretics (e.g. spironolactone) or ACE inhibitors (e.g. ramipril) or ARBs (e.g. losartan).
2. Magnesium deficiency must be repleted to adequately restore potassium.
3. If patient on digoxin, hypokalemia should be corrected IV or PO (as per above) regardless of symptoms.

Magnesium (1 mmol= 2 mEq Mg^{++})

Salt	Form	Strength	Elemental Mg^{++}
Magnesium glucoheptonate	Liquid	100 mg/mL	5 mg/mL (0.2 mmol/mL)
Magnesium complex	Tablet	50 mg, 100 mg	50 mg (2 mmol) 100 mg (4 mmol)
Magnesium sulphate	Injection	2 g/50 mL D5W 5 g/100 mL D5W	8 mmol/2 g bag 20 mmol/5 g bag

Treatment of Hypomagnesemia—see following page

Treatment of Hypomagnesemia

Status	Route	Dosage
Mild-Moderate deficiency (0.5-0.69 mmol/L)	PO	12.5-17.5 mmol Mg^{++}/day (25-35 mEq Mg^{++}/day) Magnesium glucoheptonate: 60-90 mL/day in 3-4 divided doses Mg complex: 300-400 mg/day in 2-3 divided doses
	IV	5 g magnesium sulphate (20 mmol) in 100 mL D5W or NS over 3-4 hours, repeated daily x 1-3 doses
Severe deficiency (< 0.5 mmol/L)	IV	5 g magnesium sulphate (20 mmol) in 100 mL D5W or NS over 3-4 hours. Repeat q12-24h x 3-4 doses.
Renal Insufficiency	IV	2 g magnesium sulphate (8 mmol) in 50 mL D5W or NS over 30-60 minutes OR 5 g (20 mmol) in 100 mL D5W or NS over 3-4 hours x 1 dose. Recheck serum magnesium level*

Notes:
*Can monitor serum magnesium level 4-6 hours after end of last dose in a series

$MgSO_4$ Therapeutic Interchange: IV doses ≤ 2.5 g interchanged to 2 g
IV doses > 2.5 g interchanged to 5 g

Phosphate

Salt	Form	Strength	Elemental PO_4^{3-}	Other
Phosphates solution	Liquid	500 mg/4 mL	500mg (16 mmol/4 mL)	19.3 mmol Na^+/4 mL
Potassium phosphate	Injection		15 mmol/50-250 mL D5W	22 mmol K^+ per each 15 mmol PO_4^{3-}
Sodium phosphate	Injection		15 mmol/100 mL D5W	20 mmol Na^+ per each 15 mmol PO_4^{3-}

Treatment of Hypophosphatemia

Status	Route	Dosage
Recent and uncomplicated hypophosphatemia	PO	Phosphates solution 500mg (16 mmol, 4mL) 2-4 times daily.
	IV	**Potassium Phosphate**: 15 mmol PO_4^{3-} in 50 mL D5W centrally OR in 250 mL D5W peripherally x 1. Infuse 15 mmol PO_4^{3-} over minimum 2 hours.* **Sodium Phosphate**: 15 mmol PO_4^{3-} in 100 mL D5W centrally or peripherally x 1. Infuse 15 mmol PO_4^{3-} over minimum 2 hours.*
Symptomatic hypophosphatemia	IV	15 mmol PO_4^{3-} IV x 1-3 doses (per above dilutions and rate) Higher doses of 30-45 mmol PO_4^{3-} may be administered for severe deficiency; sodium phosphate preferred with higher doses due to no potassium content Additional doses should be guided by serum phosphate levels taken no sooner than 4 hrs after infusion or next morning. Also, check serum potassium and calcium levels.

* Critical Care areas: Central line - may administer 15 mmol PO_4^{3-} over 1 hour (ECG monitoring required for Potassium phosphate)

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GENERAL MEDICINE PHARMACOTHERAPY CARD

Pain and Electrolyte Management

October 2018
8th Edition

For more information, please contact:
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or visit our website:
vhpharmsci.com/PagePocket/index.html

Hyperkalemia Management (see PPO #960)
(serum potassium of 5.5 mmol/L or greater)

Drug	Dosage
For cardiac membrane stabilization (if ECG changes)	
Calcium gluconate	1 g IV in D5W 50 mL infused over 15 mins ***OR*** 1 g IV direct over 2 to 5 mins (by MD only on general units)
For potassium shift into cells	
Dextrose 50%/ Insulin Regular **IV**	Dextrose 50% 25 g (50 mL) IV direct over 5 minutes followed immediately by Insulin Regular 10 units **IV direct**
Salbutamol	8 puffs x 1 (may use aerochamber) ***OR*** 20 mg nebulized x 1
For potassium removal	
Sodium polystyrene sulfonate (Kayexalate®)	30 g PO/NG Q4H x 2 doses ***OR*** 30 g PO/NG Q6H x 2 doses ***OR*** 30 g RECTAL as retention enema Q6H x 1 to 2 doses
Furosemide	40 to 80 mg IV direct x 1

Pain Management for Acute and Chronic Pain

Drug[1] (strengths and dosage forms)	Usual Dose Range (maximum dose/day)
Acetaminophen 325 mg tab; Solution: 32 mg/mL; Suppository: 120 mg, 325 mg, 650 mg)	325-975 mg POTID-QID (4 g/day) Rectal: 650 mg PR TID-QID
NSAIDs	
ASA 325 mg tab Enteric Coated tab: 325mg, 650mg Suppository: 650 mg	325-975 mg PO q4-6h (4 g/day) Rectal: 650 mg PR q6h
Diclofenac 25 mg, 50 mg tab; SR tab: 75 mg, 100 mg Suppository: 50 mg, 100mg Topical get: 1.16%, 2.32%, 5%, 10%	25-50 mg PO BID-TID (150 mg/day) Rectal: 50 mg PR BID Topical gel: BID-TID PRN
Ibuprofen 200 mg, 300 mg tab	200-800 mg PO TID-QID (3.2 g/day)
Indomethacin 25 mg cap; Suppository: 50 mg, 100 mg	25-50 mg PO TID (200 mg/day) Rectal: 50 mg PR TID
Naproxen 250mg tab; Suspension: 25 mg/mL	125-500 mg po BID-TID (1500 mg/day)
Ketorolac 30 mg/mL injection	15-30 mg IM/IV Q6H PRN (max 5 days)
COX 2 Inhibitors	
Celecoxib 100 mg, 200 mg cap	100 mg PO BID or 200 mg PO daily; Rheumatoid arthritis: 100-200 mg BID

[1] dosage forms available on the Vancouver Acute (VA) Formulary

Initial Dosing* for Management of ACUTE Pain in Opioid-Naïve Patients

Opioid	IV Direct (over 2 to 3 min)	IV intermittent over 15 minutes or IM / Subcutaneous	Oral
HYDROmorphone	0.1 to 0.4mg Q10 to 60MIN PRN (Max. 2 mg/hr)	0.5 to 1 mg Q3 to 4H PRN (**Frail elderly/sleep apnea**: 0.25 to 0.5 mg)	0.5 to 2 mg Q3 to 4H PRN
morphine	0.5 to 2 mg Q10 to 60MIN PRN (Max. 10 mg/hr)	2.5 to 5 mg Q3 to 4H PRN (**Frail elderly/sleep apnea**: 1.25 to 2.5 mg)	2.5 to 10 mg Q3 to 4H PRN
oxyCODone	n/a	n/a	2.5 to 7.5 mg Q3 to 4H PRN
*** doses are NOT equipotent but reflect INITIAL dosing recommendations**			

- Consider starting at lower doses for patients with the following factors: ↑ age, ↓ weight, sleep apnea, impaired renal or hepatic function, interacting drugs/ concurrent CNS depressants, pulmonary disease or conditions that cause decreased pulmonary drive, seizures
- Fentanyl patches or long-acting preparations should not be used in opioid naïve

Onset and Peak Effect of Opioids wrt Route of Administration		
Route	**Onset (minutes)**	**Peak (minutes)**
IV direct	3 to 5	10 to 20
IV intermittent	10 to15	20 to 30
IM/ SUBCUT	10 to 15	30 to 45
oral	15 to 30	60

Equianalgesic Opioid Dosing

(Equivalent to morphine 5mg IV intermittent or IM/subcutaneous)

Drug	IV Direct (mg)	IV intermittent over 15 MIN or IM/ Subcutaneous (mg)	ORAL (mg)	Duration of Action* (hours)
morphine	1	5	10 to 15	3 to 4
codeine	-	60	100	3 to 4
HYDROmorphone	0.2	1	2	3 to 4
oxyCODone	-	-	7.5 to 10	3 to 4
fentanyl	0.01 (10 mcg)	0.05 (50 mcg)	-	1 to 3
fentanyl transdermal**		25 mcg/hour = 30 to 66mg morphine IV/IM per 24 hours	25 mcg/hour = 60 to 134 mg morphine PO per 24 hours	3 days
methadone (consult CPAS or Palliative Care for new starts)		-	Depends on morphine dose (see PDTM or formulary)	Greater than 6

*Duration of action is for IV intermittent, IM/SC, and PO routes; IV direct administration has shorter duration of action

**Note that this Table is uni-directional for Morphine to Fentanyl patch conversion only. Conversion does not apply when switching from Fentanyl patch to morphine (use extreme caution)

	Fentanyl Sublingual	Sufentanil Sublingual
Equivalent Dose	50 to100 mcg	10 mcg
Dose for Incident Pain	10 to 50 mcg (0.2 to 1 mL) sublingual pre-procedure.	5 to 25 mcg (0.1 to 0.5 mL) sublingual pre-procedure. Max dose is 50 mcg (1 mL)
Onset of Effect	5 to 15 minutes (peak effect: 20 minutes)	2 to 3 minutes
When to Administer	10 minutes prior to procedure	3 to 5 minutes prior to procedure
Duration	30 to 45 minutes	10 to 25 minutes
Monitoring	Sedation scale and Respiratory Rate: Q5 to 10MIN x 30 min after each dose	Sedation scale and Respiratory Rate: Q5 to 10MIN x 25 min after each dose

Note:
Because of incomplete and variable cross-tolerance along with significant individual variation, there is no known consistent equivalent dose ratio to calculate when using these agents for incident pain. Therefore, incremental titration is required for each patient.

Prevention and Treatment of Adverse Effects of Opioids

Constipation (See Table A (Laxatives)

1. Regular doses of opioid analgesics require a regular laxative regimen Usually, a stimulant laxative is required.
2. Use a phosphate or sodium citrate enema if suppositories are ineffective; if obstruction is further up the intestinal tract, then an oil-retention enema can be used, followed hours later by a saline enema.
3. Non-pharmacological management (if possible): increase fluid, increase fibre, increase mobility.
4. Methylnaltrexone (Relistor) is restricted to opioid-induced constipation refractory to other laxatives.

Nausea (See Table B: Anti-Emetics)

1. On initiation of opioids, some patients will require PRN doses of anti-emetics. A few patients with chronic nausea will require round-the-clock dosing.
2. Impaired stomach motility may contribute to nausea(patient feels full all the time); refer to Table C: Pro-Motility Agents.
3. Monitor patient and reassess need for anti-emetics every few days. Many patients will not need continuing doses of anti-emetics unless dose is rapidly increased.
4. Switch to another opioid, or try another route of administration if nausea remains a major problem after 2-3 days and other causes having been ruled out (e.g. constipation, other medications).

Sedation, Drowsiness or Confusion

1. Mild sedation or confusion may be experienced initially and does not require any treatment as the side effect will usually clear in a few days.
2. If a patient has been on regular opioids and develops drowsiness or confusion, assess patient for other causes (e.g. delirium, changes in metabolic function, underlying illnesses, other sedating medications). Also consider opioid toxicity from decreased renal clearance (note: neither methadone nor fentanyl accumulate in renal failure).
3. Prolonged drowsiness or confusion beyond 3-4 days or severe drowsiness with any dose may require a decrease in opioid dosage. Can try switching to another opioid and titrate dose as necessary.
4. Do not use naloxone unless patient's respiratory rate is affected. Refer to Respiratory Depression section.

Table A: Laxatives

Laxative Type	Dosage	Comments
Stool Softeners		
Docusate sodium (100 mg, 200 mg cap; 4 mg/mL solution)	100-200 mg PO BID	Solution has bad taste; give with milk or fruit juice.
Stimulant Laxatives		
Sennosides A&B (12 mg tabs)	2-6 tabs PO HS-BID	Can cause cramping.
Bisacodyl (5 mg tabs; 10 mg supp)	2-6 tabs PO BID, 1 supp PR q2-3days	Can cause cramping. Use supps if patient cannot tolerate oral tabs.
Glycerin (adult suppository)	1 supp PR q2-3 days	
Osmotic Agents		
Lactulose (667 mg/mL solution)	15-60 mL PO daily-BID	Sweet taste - may be diluted in water or fruit juice.
PEG 3350 without electrolytes	17 g in 250 mL fluid daily	
Magnesium citrate (50 mg/mL solution)	250 mL PO x 1 dose	For severe constipation. Avoid in renal failure.
Saline Cathartics		
Milk of Magnesia (80 mg/mL solution)	30-60 mL PO BID	Avoid in renal failure.

Table B: Anti-Emetic Agents

Drug	Dosage	Comments
Haloperidol	0.5-2 mg IV/SC/ PO daily to TID	Adverse effects rare at low dose; usual dose is less than 2mg daily.
Metoclopramide	5-10 mg SC/IV/ PO q6h	Adverse effects can include extrapyramidal symptoms.
Dimenhydrinate	12.5-50 mg IM/ IV/SC/PO q4-6h	Especially if vertigo present. Sedation may occur.
Prochlorperazine	2.5—10 mg PO/ PR q6h	Dystonic effects and sedation may occur.
Ondansetron	4-8 mg PO/IV q8h	Use for refractory nausea/vomiting

Table C: Pro-Motility Agents

Drug	Dosage	Comments
Domperidone	10 mg PO TID	Not necessary to give before meals.
Metoclopramide	5-10mg PO/SC QID	Adverse effects can include extrapyramidal symptoms.

Psychotomimetic Effects (dysphoria, hallucinations, nightmares)

1. Usually minimal but if distressing to patient and family, switch to another opioid drug.

Respiratory Depression

1. If respiratory depression is severe (pinpoint pupils, unrousable, respiratory rate < 8/min), use naloxone 0.1-0.2 mg IV q2-3 min or 0.1-0.2 mg SC Q5-10min until respiratory rate has increased to above 10/min. Monitor respiratory rate Q15min until no naloxone given in 1 hour.
2. Vigorous use of higher doses of naloxone might cause reversal of analgesic effect, prolonged blockade of opiate receptors and severe pain that is difficult to control.

Myoclonus

1. Usually seen at higher doses of opioids.
2. May need to switch to different opioid, hydrate patient and/or decrease opioid dose.
3. If decreased dose of opioid exposes patient to unacceptable levels of pain, the following drugs in usual doses, can be effective in decreasing myoclonus: clonazepam, lorazepam, baclofen and dantrolene.
4. Consider opioid-induced neurotoxicity (myoclonus, hallucinations, delirium, decreased LOC).

Urinary Retention

1. Occurs more commonly in elderly men. Rule out other causes. May require urinary catheter.

Pruritus

1. Usually decreases with time. Not an allergy unless associated with respiratory difficulty.
2. Try antihistamines. If not effective, naloxone 0.04 mg IV Q15MIN PRN x 4 may be used. Monitor for increase in pain scores.
3. For persistent intolerable pruritus, switch to a different opioid.