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321.843.7000

Type of Policy:	**PATIENT CARE**	Category:	**MEDICATION MANGEMENT (MM)**

Title:	***Electrolyte Infusions***	Policy #:	**5070**
		Replaces #:	5180
Page:	1 of 4	Developed By:	Pharmacy, Nursing
Issue Date:	**2/05**	Approved By:	Patient Care Executive
Revision Dates:	3/06, 8/06, 2/08, 9/08, 4/09, 9/09, 1/11, 6/12, 5/14		Anne G. Peach R.N., M.S.N., N.E.A., B.C.

I. PURPOSE:

This policy outlines the process for the safe use of intravenous electrolytes (e.g., potassium chloride, potassium phosphate, magnesium sulfate, sodium phosphate, calcium chloride, calcium gluconate, concentrated sodium chloride [> 0.9%], sodium acetate, potassium acetate, and sodium bicarbonate) (not within total parental nutrition solutions.

II. DEFINITIONS:

When used in this policy these terms have the following meaning:

A. Emergency situation: Any situation in which the patient could be clinically harmed by a delay in treatment.

B. Concentrated electrolytes: Refers to potassium chloride, potassium phosphate, sodium phosphate, calcium chloride, and calcium gluconate, sodium chloride in any concentration greater than 0.9%, and magnesium sulfate in amounts exceeding 1 gram unless diluted to 50 mL or more of solution.

C. Free-flow protected infusion device: An infusion device providing free-flow protection when the pump is turned off and the set is removed from the pump without engaging gravity flow control clamps, no action is necessary to stop the flow. Examples of free-flow protection include Alaris Medley infusion pumps and Gemini pumps.

D. Independent Double Verification (IDV): Refers to the process of verification of information by two individuals as a separate task. The information verified and required staff is specific to the task being performed. High alert medications and those medication classes as well as specific medications of known risk for error require an increased level of verification.

III. POLICY:

It is the policy of Orlando Health that:

A. Concentrated electrolytes shall be removed from patient care areas. Exceptions must be approved by the Pharmacy Manager at the site and, if approved, the products must be stored in a manner which meets regulatory standards.

B. Pre-mixed or standard concentrations of potassium chloride, potassium phosphate, sodium phosphate, calcium chloride, calcium gluconate, and magnesium sulfate infusions must be used. See Attachment B for a listing.
   1. All alternative concentrations/solutions must be prepared by Pharmacy in accordance with the attachments to this policy.
   2. Exceptions must be approved by the Pharmacy Manager at the site,

C. Standardized tables for the use of parenteral electrolytes, if available shall be followed. (Attachments C-J)

D. Prescriber orders for potassium chloride piggyback administration must comply with the following:
   1. In Level I areas, orders for potassium chloride piggyback infusion shall be limited to a maximum of 120 meq of potassium chloride per order (e.g., 20 meq x 6 doses).
   2. In all other areas, orders for potassium chloride infusion shall be limited to a maximum of 60 meq of potassium chloride per order (e.g. 20 meq x 3 doses).

E. The addition of electrolytes to a hanging IV bag/syringe/buretrol is not allowed.

F. Intravenous piggyback infusions of electrolytes shall be administered by RNs only.

G. Electrolyte piggyback and maintenance infusions must be administered with free-flow protected infusion devices. Dial-a-flow devices shall not be used to administer electrolyte infusions.

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		Replaces #:	5180
Page:	2 of 4	Developed By:	Pharmacy, Nursing
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H. IDV is required for those electrolytes listed in the High Alert Medication policy, (potassium chloride and phosphate, sodium chloride > 0.9%, magnesium sulfate, calcium chloride, calcium gluconate).
Exceptions:
1. Manufacturer pre-mixed one-liter bags containing these electrolytes.
2. Manufacturer pre-mixed and Pharmacy-prepared solutions administered in a level I care area (e.g., ICUs).
   a. potassium chloride (10 or 20 mEq in 50 or 100 mL),
   b. calcium gluconate (1 gram in 50 mL or 2 grams in 100 mL),
   c. calcium chloride (1 gram in 50mL) and
   d. Magnesium sulfate (1 gram in 100 mL or 2 grams in 50 mL).

I. In emergency situations, magnesium sulfate (2 grams in 50 mL) shall be prepared for immediate administration. Calcium chloride (1 gram in 100 mL) shall be prepared for immediate use in emergency situations only in level I areas (the Emergency Department, Intensive Care Units, and Operating Rooms).

J. Potassium phosphate and sodium phosphate must be ordered in millimoles (mmol). Orders written in milliequivalents (mEq) must be clarified.

IV. PROCEDURE:

A. Verify the physician order.

B. Dispensing:
1. When available, premixed solutions will be used.
2. No more than 80 mEq of potassium chloride will be added to 1,000 mL of any solution (excluding total parenteral nutrition admixtures).
3. No more than 20 mEq of potassium chloride will be added to 50 or 100 mL of any solution.
   In patients weighing less than 40 kg, no more than 0.5 mEq/kg of potassium chloride will be added to a small volume piggyback infusion (i.e., < 100 mL).
4. The total potassium from all IV fluids a patient is concurrently receiving (e.g.., piggyback infusions, maintenance fluids, parenteral nutrition, etc.) will be calculated to confirm the perimeters for concentration, rate of administration, and monitoring parameters stated for potassium chloride are not exceeded.

C. Administration of electrolyte infusions:
1. Obtain appropriate infusion device (e.g., infusion pump) as defined in Attachments C, D, and E.
2. Identify the patient using two acceptable identifiers.
3. Electrolyte infusions will be administered by the suggested route to minimize the rate of infusion complications.
   a. Refer to the appropriate attached electrolyte table.
   b. Sodium bicarbonate infusions will be administered using infusion pump library safeguards (e.g. Guardrails). Exception: In operating rooms.
4. IDV will occur:
   a. When initiating an electrolyte infusion,
   b. With all subsequent bag/syringe changes, and
   c. With dose changes requiring adjustments in pump settings.

D. Monitoring:
1. Observe for signs of pain, erythema, swelling or burning at site for peripheral administration of electrolytes.

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Type of Policy:	**PATIENT CARE**	Category:	**MEDICATION MANGEMENT (MM)**

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2. As appropriate assess the patient's ECG rhythm for any electrographic evidence of changes including but not limited to, peaked T-waves, absent P-waves, widened QRS complexes and arrhythmias.

E. Precautions:
1. The administration of electrolyte infusions will be guided by laboratory results as appropriate.
2. In cases of hyponatremia, sodium chloride replacement will not be corrected (based on serum sodium concentrations) faster than 0.5 mEq/L/hr (serum sodium concentration) and will not exceed 12 mEq/L (serum sodium concentration) in 24 hours. The physician will be contacted for corrections in serum sodium concentrations exceeding 0.5mEq/L/hr or 12 mEq/L in 24 hours.
3. The addition of sodium bicarbonate or lidocaine to potassium chloride piggy back and maintenance infusions is not recommended, as the increased osmotic load shall worsen phlebitis.
4. Serum creatinine will be monitored daily, when administering infusions of magnesium.

V. DOCUMENTATION:

As appropriate in the medical record.

VI. REFERENCES:

A. Adult Electrolyte Replacement Protocol Form #5872-28972 XA.
B. Charron, T., et al. (2003). Intravenous phosphate in the intensive care unit: More aggressive repletion regimens for moderate and severe hypophosphatemia. *Intensive Care Medicine 29*, 1273-1278.
C. Decaux, G., & Soupart, A. (2003). Treatment of symptomatic hyponatremia. *American Journal of Medical Science, 326*, 25-30.
D. Obstetrical Services Policy and Procedure #1263-0120, *Administration of Obstetrical Magnesium Sulfate.*
E. Patient Care Policy and Procedure #0282, *Independent Double Verification.*
F. Patient Care Policy and Procedure #0335, *Patient Identification*.
G. Patient Care Policy and Procedure #5130, *Medication Administration*.
H. Phelps S. J., Hak E. B., & Crill C. M. (2011). *Pediatric Injectable Drugs. (9th e. d.*). Bethesda, MD: American Society of Health-System Pharmacists.
I. Taketomo, C.K., Hodding, J.H., & Kraus, D.M. (2011). *Pediatric Dosage Handbook. (18th e. d.*). Hudson, OH: Lexi-Comp.
J. Trissel, L. A. (2013). *Handbook on Injectable Drugs (17th e. d.).* American Society of Health-System Pharmacists. Bethesda, MD.
K. Young, T. E., & Mangum, B. (2011). *Neofax (24th e. d.).* Raleigh, NC: Acorn Publishing, Inc.

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VII. ATTACHMENTS:

A. Levels of Care Table, one page.
B. Standard Concentrations for Electrolyte Solutions, two pages.
C. Potassium Chloride Infusions in Adults, two pages.
D. Potassium Chloride Infusions in Pediatrics, two pages.
E. Potassium Phosphate Infusions, one page.
F. Sodium Phosphate Infusions, one page.
G. Magnesium Sulfate Infusions, two pages.
H. Calcium Chloride and Calcium Gluconate Infusions, two pages.
I. Concentrated Sodium Chloride Solution Infusions in Adults, two pages.
J. Concentrated Sodium Chloride Infusions in Pediatrics, one page.

* Approved by the Pharmacotherapy Committee April 21, 2014.

1414 Kuhl Ave.
Orlando, Florida 32806
321.843.7000

Title: ***ELECTROLYTE INFUSIONS*** Policy #: **5070**

Attachment A - Levels of Care

The table below defines the Acuity of Care Level required to administer intravenous electrolyte infusions.

Only RNs/GNs shall administer intravenous piggyback infusions of electrolytes.

This table does not apply during Code Blue 90 and Code Blue 45 situations.

Acuity of Care Level	**Optimal Ns to Pt Ratio**	**Monitoring/Equipment Requirements**	**Electrolyte infusions shall be administered at this acuity level**
Level I – High acuity	1:1 to 1:2	Monitoring of vital signs and/or ECG is performed at least every 2 hours or more frequently as the clinical case and/or medication dictates	Level I, II and III electrolyte infusions shall be administered in level I areas.
Level II – Moderate acuity	1:3 to 1:5	Monitoring of vital signs and ECG (if indicated for the specific medication as listed in the following table), is performed at least every 4 hours and can be monitored more frequently as the clinical case and/or medication dictates.	Level II and III electrolyte infusions shall be administered in Level II areas.
Level III – Lower acuity	1:6 and above	Monitoring of vitals signs and/or cardiac function is performed at least once per shift	Level III electrolyte infusions shall be administered in Level I, II and III areas.

NOTES:

- **= Administration via central line is preferred: however, can be given peripherally with adequate IV access.**

1414 Kuhl Ave.
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Potassium Chloride Large Volume Premixed Solutions:

IDV NOT Required for 1000 mL bags

Base Solution Type	Commercially Available Premixed Large Volume Parenteral Products with Potassium Chloride
D5W	D5W with 20 mEq KCL 1000 mL
	D5W with 40 mEq KCL 1000 mL
D5NS	D5NS with 20 mEq KCL 1000 mL
	D5NS with 40 mEq KCL 1000 mL
D5 / ½ NS	D5/ ½ NS with 20 mEq KCL 1000 mL
	D5/ ½ NS with 40 mEq KCL 1000 mL
	D5/ ½ NS with 10 mEq KCL 1000 mL
	D5/ ½ NS with 30 mEq KCL 1000 mL
D5 / ¼ NS	D5/ ¼ NS with 20 mEq KCL 1000 mL
	D5/ ¼ NS with 40 mEq KCL1000 mL
D5LR	D5LR with 20 mEq KCL 1000 mL
NS	NS with 20 mEq KCL 1000 mL
	NS with 40 mEq KCL 1000 mL
½ NS	½ NS with 20 mEq KCL 1000 mL

NOTE: 1/2NS shall be labeled as 0.45%NS, 1/4NS shall be labeled as 0.2%NS or 0.225%NS

Attachment continues on next page.

1414 Kuhl Ave.
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Title: ***ELECTROLYTE INFUSIONS*** Policy #: **5070**

Attachment B - Standard Concentrations Electrolyte Solutions

WHEN THE FOLLOWING MANUFACTURER PRE-MIXED OR PHARMACY-PREPARED SOLUTIONS ARE ADMINISTERED IN A LEVEL I CARE AREA, IDV IS NOT REQUIRED: ***potassium chloride (10 or 20 mEq in 50 or 100 mL), calcium gluconate (1 gram in 50 mL or 2 grams in 100 mL), calcium chloride (1 gram in 50mL) and magnesium sulfate (1 gram in 100 mL or 2 grams in 50 mL).***

Potassium Chloride Small Volume Premixed Solutions:

Piggyback infusions prepared with sterile water for injection (SWI) are preferred in most patients, because the osmolality is closer to that of blood, thus minimizing the risk of phlebitis. Piggyback infusions mixed in normal saline (NS) will be supplied to selected units caring for patients requiring a saline-based diluent.	
10 mEq KCL in 50 mL SWI	10 mEq KCL in 100 mL SWI
10 mEq KCL in 50 mL NS	10 mEq KCL in 100 mL NS
20 mEq KCL in 50 mL SWI	20 mEq KCL in 100 mL SWI
20 mEq KCL in 50 mL NS	20 mEq KCL in 100 mL NS

Magnesium Sulfate Premixed Solutions.

- Magnesium sulfate 1 gram / 100 mL
- Magnesium sulfate 2 grams / 50 mL
- Magnesium sulfate 4 grams / 50 mL
- Magnesium sulfate 6 grams / 50 mL
- Magnesium sulfate 25 grams /300 mL

Potassium Phosphate Standard Solutions:

- Potassium phosphate 15 mmol / 250 mL
- Potassium phosphate 21 mmol / 250 mL

The maximum amount of potassium phosphate added to any one bag will be 21 mmol / 250 mL

Sodium Phosphate Standard Solutions:

- Sodium phosphate 15 mmol / 250 mL
- Sodium phosphate 21 mmol / 250 mL
- Sodium phosphate 30 mmol / 250 mL

Calcium *Chloride* Standard Solutions:

- Calcium chloride 1 gram / 50 mL
- Calcium chloride 2 grams / 100 mL
- Calcium chloride 3 grams / 150 mL
- Calcium chloride 10 grams / 1000 mL

Calcium *Gluconate* Standard Solutions:

- Calcium gluconate 1 gram / 50 mL
- Calcium gluconate 2 grams / 100 mL
- Calcium gluconate 3 grams/150 mL (for plasmapheresis ONLY)
- Calcium gluconate 10 grams / 500 mL

1414 Kuhl Ave.
Orlando, Florida 32806
321.843.7000

Title: ***ELECTROLYTE INFUSIONS*** Policy #: **5070**

Attachment C - Potassium Chloride Infusions in Adults

Potassium Chloride

Piggyback Infusion in Adults

IDV is required (unless administered as a manufacturer pre-mixed or Pharmacy-prepared solution in a Level I area).

Administration Device

Use infusion pump for piggyback infusion regardless of amount of KCL or IV fluid volume.

Peripheral Administration

Note: KCL piggyback and maintenance solutions will be administered via central venous access if available to minimize the risk of phlebitis

Concentration	Recommended Rate	Maximum Rate in Emergency Situations:	Acuity of Care Level
Recommended Concentration: 10 mEq/100 mL **Maximum Concentration** *(e.g., for renal impairment, critically ill patients, etc.)* 10 mEq/50 mL	**With ECG Monitoring:** Alone: Up to 20 mEq/hour *Combination of piggyback (up to 20 mEq/h) and maintenance infusions or TPN (up to 10 mEq/h): up to 30 mEq/hour **Without ECG Monitoring:** Alone: Up to 10 mEq/hr *Combination of piggyback (up to 10 mEq/hour) and maintenance infusions or TPN (up to 5 mEq/hour): up to 15 mEq/hour	*Emergency Situation: Including but not limited to severe hypokalemia associated with cardiac arrhythmias, diabetic ketoacidosis, and diuretic phase of acute renal failure.* *Combination of all KCL infusions > 20 mEq/hour up to 40 mEq/hour **with continuous ECG** monitoring.	**All Levels** **Note:** *Maximum amount per physician order for KCL piggyback infusions are limited per acuity of care level* ***Levels II and III*** *areas are limited to 60 mEq KCL per order (e.g., 20 mEq KCL x 3 doses)* ***Level I*** *areas are limited to120 mEq KCL per order (e.g., 20 mEq KCL x 6 doses)*

Central Line Administration

Concentration	Recommended Rate	Maximum Rate in Emergency Situations:	Acuity of Care Level
Recommended Concentration 10 mEq/100 mL (up to 10 mEq/50 mL) **Maximum Concentration** *(e.g., for renal impairment, critically ill patients, etc.)* 20 mEq/50 mL	**With ECG Monitoring:** Alone: Up to 20 mEq/hour *Combination of piggyback (up to 20 mEq/hour) and maintenance infusions or TPN (up to 10 mEq/hour): up to 30 mEq/hour **Without ECG Monitoring:** Alone: Up to 10 mEq/hour *Combination of piggyback (up to 10 mEq/hour) and maintenance infusions or TPN (up to 5 mEq/hour): up to 15 mEq/hour	*Emergency Situation: Including but not limited to severe hypokalemia associated with cardiac arrhythmias, diabetic ketoacidosis, and diuretic phase of acute renal failure.* *Combination of all KCL infusions > 20 mEq/hour up to 40 mEq/hour **with continuous ECG** monitoring.	**All Levels** **Note:** *Maximum amount per physician order for KCL piggyback infusions are limited per acuity of care level* ***Levels II and III*** *areas are limited to 60 mEq KCL per order (e.g., 20 mEq KCL x 3 doses)* ***Level I*** *areas are limited to120 mEq KCL per order (e.g., 20 mEq KCL x 6 doses)*

* The total potassium infusion rate from all IV fluids a patient is concurrently receiving (e.g., piggyback infusion, maintenance fluids, parenteral nutrition, etc.) will be calculated to guarantee the perimeters for concentration, rate of administration, and monitoring parameters are not exceeded.

1414 Kuhl Ave.
Orlando, Florida 32806
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Title: ***ELECTROLYTE INFUSIONS*** Policy #: **5070**

Attachment C - Potassium Chloride Infusions in Adults

Potassium Chloride

Maintenance Infusion in Adults

IDV not required if manufacturer pre-mixed one-liter bags are used for administration.

Administration Device

Use infusion pump for maintenance infusion regardless of amount of KCL or IV fluid volume.

Peripheral Administration

NOTE: KCL piggyback and maintenance solutions will be administered via central venous access if available to minimize the risk of phlebitis

Concentration	Recommended Rate	Maximum Rate in Emergency Situations:	Acuity of Care Level
Recommended Concentration 10 to 40 mEq/1000 mL **Maximum Concentration** *(e.g., for renal impairment, critically ill patients, etc.)* 10 to 80 mEq/1000 mL	**With ECG Monitoring:** Alone: Up to 20 mEq/hour *Combination of piggyback (up to 20 mEq/hour) and maintenance infusions or TPN (up to 10 mEq/hour): up to 30 mEq/hour **Without ECG Monitoring:** Alone: Up to 10 mEq/hour *Combination of piggyback (up to 10 mEq/hour) and maintenance infusions or TPN (up to 5 mEq/hour): up to 15 mEq/hour	*Emergency Situation: Including but not limited to severe hypokalemia associated with cardiac arrhythmias, diabetic ketoacidosis, and diuretic phase of acute renal failure.* *Combination of all KCL infusions > 20 mEq/hour up to 40 mEq/hour **with continuous ECG** monitoring.	All Levels

Central Line Administration

Concentration	Recommended Rate	Maximum Rate in Emergency Situations*:	Acuity of Care Level
Recommended Concentration 10 to 40 mEq/1000 mL **Maximum Concentration** *(e.g., for renal impairment, critically ill patients, etc.)* 10 to 80 mEq/1000 mL	**With ECG Monitoring:** Alone: Up to 20 mEq/hour *Combination of piggyback (up to 20 mEq/hour) and maintenance infusions or TPN (up to 10 mEq/hour): up to 30 mEq/hour **Without ECG Monitoring:** Alone: Up to 10 mEq/hour *Combination of piggyback (up to 10 mEq/hour) and maintenance infusions or TPN (up to 5 mEq/hour): up to 15 mEq/hour	*Emergency Situation: Including but not limited to severe hypokalemia associated with cardiac arrhythmias, diabetic ketoacidosis, and diuretic phase of acute renal failure.* *Combination of all KCL infusions > 20 mEq/hour up to 40 mEq/hour **with continuous ECG** monitoring.	All Levels

* The total potassium infusion rate from all IV fluids a patient is concurrently receiving (e.g., piggyback infusion, maintenance fluids, parenteral nutrition, etc.) will be calculated to guarantee the perimeters for concentration, rate of administration, and monitoring parameters are not exceeded.

1414 Kuhl Ave.
Orlando, Florida 32806
321.843.7000

Title: ***ELECTROLYTE INFUSIONS*** Policy #: **5070**

Attachment D - Potassium Chloride Infusions In Pediatrics

Potassium Chloride

Piggyback Infusion in Pediatrics

IDV is required (unless administered as a manufacturer pre-mixed or Pharmacy-prepared solution in a Level I area).

Administration Device

Use infusion pump or syringe pump for all IV infusions regardless of amount of KCL or IV fluid volume.

Peripheral Administration

NOTE: KCL piggyback and maintenance solutions will be administered via central venous access if available to minimize the risk of phlebitis

Concentration	**Recommended Rate**	**Maximum Rate in Emergency Situations:**	**Acuity of Care Level**
Recommended Concentration: 10 mEq/100 mL **Maximum Concentration** *(e.g., for renal impairment, critically ill patients, etc.)* 10 mEq/50 mL **ICU patients with continuous ECG monitoring:** 10 mEq/50 mL	**With ECG Monitoring:** *Combination of all KCL infusions up to 0.5 mEq/kg/hour (up to a maximum of 30 mEq/hour) **Without ECG Monitoring:** *Combination of all KCL infusions up to 0.3mEq/kg/hour (up to a maximum of 12 mEq/hour)	*Emergency Situation: Including but not limited to severe hypokalemia associated with cardiac arrhythmias, diabetic ketoacidosis, and diuretic phase of acute renal failure.* *Combination of all KCL infusions up to 1 mEq/kg/hour with **continuous ECG** monitoring.	All Levels **Note:** *Maximum amount per physician order for KCL piggyback infusions are limited per acuity of care level* *Levels II and III areas are limited to 60 mEq KCL per order with a maximum of 20 mEq per dose (e.g., 20 mEq KCL x 3 doses)* *Level I areas are limited to120 mEq KCL per order with a maximum of 20 mEq per dose (e.g., 20 mEq KCL x 6 doses.)*

Central Line Administration

Concentration	**Rate**	**Maximum Rate in Emergency Situations:**	**Acuity of Care Level**
Recommended Concentration 10 mEq/100 mL **Maximum Concentration** *(e.g., for renal impairment, critically ill patients, etc.)* 20 mEq/50 mL **ICU patients with continuous ECG monitoring:** 1 mEq/mL	**With ECG Monitoring:** *Combination of all KCL infusions up to 0.5 mEq/kg/hour (up to a maximum of 30 mEq/hour) **Without ECG Monitoring:** *Combination of all KCL infusions up to 0.3mEq/kg/hour (up to a maximum of 12 mEq/hour)	*Emergency Situation: Including but not limited to severe hypokalemia associated with cardiac arrhythmias, diabetic ketoacidosis, and diuretic phase of acute renal failure.* *Combination of all KCL infusions up to 1 mEq/kg/hour with **continuous ECG** monitoring.	All Levels **Note:** *Maximum amount per physician order for KCL piggyback infusions are limited per acuity of care level* *Levels II and III areas are limited to 60 mEq KCL per order with a maximum of 20 mEq per dose (e.g., 20 mEq KCL x 3 doses)* *Level I areas are limited to120 mEq KCL per order with a maximum of 20 mEq per dose (e.g., 20 mEq KCL x 6 doses.)*

* The total potassium infusion rate from all IV fluids a patient is concurrently receiving e.g., piggyback infusion, maintenance fluids, parenteral nutrition, etc.) will be calculated to guarantee the perimeters for concentration, rate of administration, and monitoring parameters are not exceeded.

1414 Kuhl Ave.
Orlando, Florida 32806
321.843.7000

Title: ***ELECTROLYTE INFUSIONS*** Policy #: **5070**

Attachment D - Potassium Chloride Infusions In Pediatrics

Potassium Chloride

Maintenance Infusion in Pediatrics

IDV not required if manufacturer pre-mixed one-liter bags are used for administration.

Administration Device

Use infusion pump or syringe pump for all IV infusions regardless of amount of KCL or IV fluid volume.

Peripheral Administration

NOTE: KCL piggyback and maintenance solutions will be administered via central venous access if available to minimize the risk of phlebitis

Concentration	Recommended Rate	Maximum Rate in Emergency Situations:	Acuity of Care Level
Recommended Concentration 10 to 40 mEq/1000 mL **Maximum Concentration** *(e.g., for renal impairment, critically ill patients, etc.)* 10 to 80 mEq/1000 mL (or 0.08 mEq/mL) **ICU patients with continuous ECG monitoring:** 10 to 80 mEq/1000 mL (or 0.08 mEq/mL)	**With ECG Monitoring:** *Combination of all KCL infusions up to 0.5 mEq/kg/hour (up to a maximum of 30 mEq/hour) **Without ECG Monitoring:** *Combination of all KCL infusions up to 0.3mEq/kg/hour (up to a maximum of 12 mEq/hour)	*Emergency Situation: Including but not limited to severe hypokalemia associated with cardiac arrhythmias, diabetic ketoacidosis, and diuretic phase of acute renal failure.* *Combination of all KCL infusions up to 1 mEq/kg/hour with **continuous ECG** monitoring.	All Levels

Central Line Administration

Concentration	Recommended Rate	Maximum Rate in Emergency Situations:	Acuity of Care Level
Recommended Concentration 10 to 40 mEq/1000 mL **Maximum Concentration** *(e.g., for renal impairment, critically ill patients, etc.)* 10 to 80 mEq/1000 mL (or 0.08 mEq/mL) **ICU patients with continuous ECG monitoring:** 1 mEq/mL	**With ECG Monitoring:** *Combination of all KCL infusions up to 0.5 mEq/kg/hour (up to a maximum of 30 mEq/hour) **Without ECG Monitoring:** *Combination of all KCL infusions up to 0.3mEq/kg/hour (up to a maximum of 12 mEq/hour)	*Emergency Situation: Including but not limited to severe hypokalemia associated with cardiac arrhythmias, diabetic ketoacidosis, and diuretic phase of acute renal failure.* *Combination of all KCL infusions up to 1 mEq/kg/hour with **continuous ECG** monitoring.	All Levels

* The total potassium infusion rate from all IV fluids a patient is concurrently receiving (e.g.., piggyback infusion, maintenance fluids, parenteral nutrition, etc.) will be calculated to guarantee the perimeters for concentration, rate of administration, and monitoring parameters are not exceeded.

1414 Kuhl Ave.
Orlando, Florida 32806
321.843.7000

Title: ***ELECTROLYTE INFUSIONS*** Policy #: **5070**

Attachment E - Potassium Phosphate Infusions

Potassium Phosphate

Adult and Pediatric Patients

(must be ordered in mmol)

3 mmol potassium phosphate = 4.4 mEq potassium

Note: Concentration and infusion rate are limited by potassium content.

IDV is required.

Administration Device

Adult patients:

Use infusion pump for maintenance infusion regardless of amount of potassium phosphate or IV fluid volume.

Pediatric patients:

Use infusion pump or syringe pump for all IV infusions regardless of amount of potassium or IV fluid volume.

	Standard Concentration	Recommended Rate		Maximum Rate	IV Access	Acuity of Care Level
ADULTS	**Standard Concentrations:** 15 mmol / 250 mL 21 mmol / 250 mL	**With or Without ECG Monitoring:** 15-30 mmol over 4 hours (3 mmol/hour = 4.4 mEq potassium per hour)		**With ECG Monitoring** 10 mmol/hour* (15 mEq potassium per hour) **Without ECG Monitoring:** 7 mmol/hour (10 mEq potassium per hour)	Central or Peripheral	All Levels

PEDIATRICS	**Standard Concentration**	**Recommended Rate**		**Maximum Concentration**	**Maximum Rate**	**IV Access**	**Acuity of Care Level**
	0.05 mmol/mL peripheral 0.12 mmol/mL central	0.02-0.04 mmol/kg/hour		0.05 mmol/mL peripheral 0.12 mmol/mL central	**With ECG Monitoring:** 0.2 mmol/kg/hour **Without ECG Monitoring:**0.06 mmol/kg/hour	Central or peripheral Central ONLY	All Levels

* Maximum 10 mmol/hour EXCEPT in patients with significant hypercalcemia (=serum Ca X serum phosphate >60 mg^2/dL^2). If significant hypercalcemia is present, do not exceed recommended rate (3-7 mmol/hour).

The total potassium infusion rate from all IV fluids a patient is receiving (e.g., piggyback infusion, maintenance fluids, parenteral nutrition, etc.) will be calculated to guarantee the requirements of the potassium policy are met.

1414 Kuhl Ave.
Orlando, Florida 32806
321.843.7000

SODIUM PHOSPHATE
(Must be ordered in mmol)

3 mmol sodium phosphate = 4 mEq sodium

IDV is not required.
Use infusion pump.

	Standard Concentrations	Recommended Rate		Maximum Rate	IV Access	Acuity of Care Level
ADULTS	15 mmol / 250 mL 21 mmol / 250 mL 30 mmol / 250 mL	15-30 mmol over 4 hours		10 mmol/hour *Except in patients with significant hypercalcemia* *(= serum Ca X serum phosphate > 60 mg^2/dL^2).* Do not exceed 3-7 mmol/hour in these patients.	Central or Peripheral	All Levels

	Standard Concentration	Recommended Rate		Maximum Concentration	Maximum Rate	IV Access	Acuity of Care Level
PEDIATRICS	0.05 mmol/mL peripheral 0.12 mmol/mL central	0.02-0.04 mmol/kg/hour		0.05 mmol/mL peripheral 0.12 mmol/mL central	**With ECG Monitoring:** 0.2 mmol/kg/hour **Without ECG Monitoring:** 0.06 mmol/kg/hour	Central or peripheral	All Levels

1414 Kuhl Ave.
Orlando, Florida 32806
321.843.7000

MAGNESIUM SULFATE

See the next page for dosing for obstetric specific indications

1 gram magnesium sulfate = 98.6 mg elemental magnesium=8.1 mEq magnesium

IDV is required (unless dose is no more than 2 grams and is administered as a manufacturer pre-mixed or Pharmacy-prepared solution in a Level I area).

Use infusion pump.

ADULTS *Recommended maximum per day = 40 grams*	**Standard Concentrations**	**Recommended Rate**	**IV Access**	**Acuity of Care Level**
	1 gm / 100 mL 2 gm / 50 mL	33 mg/minute (2 grams/hour)	Central or Peripheral	All Levels
		Maximum Rate	**IV Access**	**Acuity of Care Level**
		150 mg/minute	Central or Peripheral	Level II

PEDIATRICS	**Recommended Concentration**	**Recommended Rate**	**IV Access**	**Acuity of Care Level**
	4% = 40 mg/mL (2 grams/50 mL)	60 mg/kg/hour (up to 2 grams/hour)	Central or Peripheral	All Levels
	Maximum Concentration	**Maximum Rate**	**IV Access**	**Acuity of Care Level**
	20% = 200 mg/mL (20 grams/100 mL)	125 mg/kg/hour *or* 150 mg/min – whichever is less	Central or Peripheral	Level II

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MAGNESIUM SULFATE – OB/GYN INFUSIONS

Dosing for Preeclampsia, Eclampsia, and Tocolysis in Obstetric Patients Only

1 gram magnesium sulfate = 98.6 mg elemental magnesium=8.1 mEq magnesium

IDV is required. Use infusion pump.

Indication	Concentration	Recommended Rate	Maximum Rate	IV Access	Acuity of Care Level
Preeclampsia	4 gm / 50 mL 25 gm / 300 mL	4 gms at 133 mg/min 1-2 gm / hr	4 gms at 267 mg/ min 3 gm / hr	Central or Peripheral	All Levels
Indication	**Concentration**	**Recommended Rate**	**Maximum Rate**		
Eclampsia	6 gm / 50ml 4 gm / 50ml 2 gm / 50ml 25gm / 300ml	6 gms at 300mg/min 4 gms at 267mg/min 2 gms at 400mg/min 1-2 gm / hr	6 gms at 300mg/min 4 gms at 267mg/min 2 gms at 400mg/min 3 gm / hr		NOTE 1:4 nurse to mother-baby couplet ratio on postpartum floors
Indication	**Concentration**	**Recommended Rate**	**Maximum Rate**	**IV Access**	**Acuity of Care Level**
Tocolysis	6 gm / 50 mL 4 gm / 50 mL 25 gm / 300 mL	6 gms at 150 mg / min 4 gms at 133 mg/ min 1-2 gm / hr	6 gms at 300 mg / min 4 gms at 200 mg/ min 4 gm / hr	Central or Peripheral	All Levels

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CALCIUM CHLORIDE (available as a 10% solution)

1 gram of calcium chloride = 270 mg elemental calcium = 14 mEq calcium

IDV is required (unless the dose is no more than 1 gram and is administered as a manufacturer pre-mixed or Pharmacy-prepared solution in a Level I area).

Use infusion pump.

ADULTS	**Standard Concentrations**	**Recommended Rate**	**Maximum Rate**	**IV Access**	**Acuity of Care Level**
	1 gm/50 mL 2 gm/100 mL 3 gm/150 mL 10 gm/1000 mL (for use in Continuous Renal Replacement Therapy only)	≤3 grams/hour	1 gram over 10 min (1.8 mEq elemental calcium/minute)	Central line required	Level I

PEDIATRICS **Shall use peripheral line if no other access available*	**Recommended Concentration**	**Maximum Concentration**	**Recommended Rate**	**Maximum Rate**	**IV Access**	**Acuity of Care Level**
	≤ 20 mg/mL	30 mg/mL	0.01 mEq/kg/minute *or* 45 mg/kg/hour	0.02 mEq/kg/minute *or* 90 mg/kg/hour	Central line preferred; peripheral administration with adequate IV access	Level I

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CALCIUM GLUCONATE (available as a 10% solution)

1 gram of calcium gluconate = 90 mg elemental calcium = 4.5 mEq calcium

IDV is required (unless dose is no more than 2 grams and is administered as a manufacturer pre-mixed or Pharmacy-prepared solution in a Level I area).
Use infusion pump,

	Standard Concentrations	**Recommended Rate**	**Maximum Rate**	**IV Access**	**Acuity of Care Level**
ADULTS	1 gm/50 mL 2 gm/100 mL 3 gm/150 mL (for plasmapheresis ONLY) 10 gm/500 mL (for use in Endocrine surgery only)	2 grams/hour (33.3 mg/minute)	2 grams/hour (33.3 mg/minute)	Central line preferred; administration through a large peripheral vein with adequate IV access is acceptable	All Levels
		2 grams/hour (33.3 mg/minute)	3 grams over 10 minutes (at 300 mg/minute) **OR** 1.5 mEq elemental calcium per minute	Central line preferred; administration through a large peripheral vein with adequate IV access is acceptable	Level I

	Recommended Concentration	**Maximum Concentration**	**Recommended Rate**	**Maximum Rate**	**IV Access**	**Acuity of Care Level**
PEDIATRICS *Shall use peripheral line if no other access available*	30 mg/mL of Calcium gluconate	30 mg/mL of Calcium gluconate	0.01 mEq/kg/minute *or* 120 mg/kg/hour	0.01 mEq/kg/minute *or* 120 mg/kg/hour	Central line preferred; peripheral administration with adequate IV access	All Levels
	30 mg/mL of Calcium gluconate	100 mg/mL of Calcium gluconate	0.01 mEq/kg/minute *or* 120 mg/kg/hour	0.02 mEq/kg/minute *or* 240 mg/kg/hour	Central line required	Level I

	Concentration	**Recommended Rate**	**Maximum Rate**	**IV Access**	**Acuity of Care Level**
Obstetric Magnesium Sulfate Toxicity	100 mg / mL of Calcium Gluconate	1 gram over 5 minutes	1 gram over 3 minutes	Central or Peripheral	All Levels

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CONCENTRATED SODIUM SOLUTIONS

ADULTS BY INDICATION

IDV is required for all sodium chloride solutions in concentrations greater than 0.9%.Use infusion pump.

Refractory Intra-cranial Hyperten-sion	**Concentration**	**Dose**	**Maximum Infusion Rate**	**Monitoring**	**IV Access**	**Acuity of Care Level**
	23.4% NaCl	30 mL	Over 15-20 minutes	Patient specific *	Central line required	Level I
Cerebral Edema	**Concentration**	**Recommended Rate**	**Maximum Rate**	**Monitoring**	**IV Access**	**Acuity of Care Level**
	1.5% NaCl or NaAcetate	Up to 150 mL/hour	N/A	Patient specific*	Central line preferred; administration through a large peripheral vein with adequate IV access is acceptable	Level I
	3% NaCl or NaAcetate	Up to 150 mL/hour	N/A	Stat serum sodium levels must be assessed every 4 hours Maximum serum sodium increase of 0.5 mEq/L/hr*	Central line preferred; administration through a large peripheral vein with adequate IV access is acceptable	Level I
	3% NaCl or NaAcetate	Up to 40 mL/hour	40 mL/hour	Stat serum sodium levels must be assessed every 4 hours Maximum serum sodium increase of 0.5 mEq/L/hr*	Central line preferred; administration through a large peripheral vein with adequate IV access is acceptable	Level II (exception: neuro-specialty unit at ORMC for patients with a neurologic diagnosis)
	7.5% NaCl (Bolus ONLY)	4 mL/kg	999 ml/hr via infusion pump	N/A	Central line preferred; administration through a large peripheral vein with adequate IV access is acceptable	Level I

* The physician will be contacted for changes in serum sodium concentrations exceeding 0.5mEq/L/hr (= 2 mEq/L in 4 hours).

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CONCENTRATED SODIUM SOLUTIONS

ADULTS BY INDICATION

IDV is required for all sodium chloride solutions in concentrations greater than 0.9%. Use infusion pump.

	Concentration	Recommended Rate	Maximum Rate	Monitoring	IV Access	Acuity of Care Level
Hypo-natremia	3% NaCl or NaAcetate	30-40 mL/hour	4-5 mL/kg/hour over 1-2 hours	Stat serum sodium levels must be assessed every 4 hours Recommended maximum serum sodium increase of 0.5 mEq/L/hr*	Central line preferred; administration through a large peripheral vein with adequate IV access is acceptable	Level I
	3% NaCl or NaAcetate	≤ 40 mL/hour	40 ml/hr	Stat serum sodium levels must be assessed every 4 hours Recommended maximum serum sodium increase of 0.5 mEq/L/hr*	Central line preferred; administration through a large peripheral vein with adequate IV access is acceptable	Level II (exception : neuro-specialty unit at ORMC for patients with a neurologic diagnosis)
	1.5% NaCl or NaAcetate	Up to 150 mL/hr	N/A	Patient specific*	Central line preferred; administration through a large peripheral vein with adequate IV access is acceptable	Level III
	0.9% NaCl or NaAcetate	Patient specific	N/A	Patient specific*	Central or Peripheral	Level III

*physician will be contacted for changes in serum sodium concentrations exceeding 0.5mEq/L/hr (= 2 mEq/L in 4 hours).

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CONCENTRATED SODIUM CHLORIDE (NaCl) (>0.9%)

PEDIATRICS BY INDICATION
IDV is required for all sodium chloride solutions in concentrations greater than 0.9%.
Use infusion pump.

Acute (<36-48 hours) Hyponatremia *(Serum Na < 115 mEq/L if asymptomatic or < 136 mEq/L and symptomatic)*	**Recommended Concentration (for Non- Severe Cases)**	**Recommended Rate (for Non-Severe Cases)**	**IV Access**	**Acuity of Care Level**
	3% NaCl	1-2 mL/kg/hour (serum sodium levels must be assessed every 4 hours) Do Not correct serum sodium faster than 0.5 mEq/L/hour or exceed 12 mEq/L in 24 hours	Central line preferred; peripheral administration with adequate IV access	Level II
	Maximum Concentration (for Severe Cases)	**Maximum Rate (for Severe Cases)**	**IV Access**	**Acuity of Care Level**
	3% NaCl	4-5 mL/kg/hour over 1-2 hours (serum sodium levels must be assessed every 4 hours) Do Not correct serum sodium faster than 0.5 mEq/L/hour or exceed 12 mEq/L in 24 hours	Central line preferred; peripheral administration with adequate IV access	Level I

Intracranial Hypertension	**Maximum Concentration**	**Maximum Rate**	**IV Access**	**Acuity of Care Level**
	3% NaCl	5 mL/kg over 30 minutes (2.5 mEq/kg over 30 minutes)	Central line preferred; peripheral administration with adequate IV access	Level I