

Refeeding Syndrome (RFS) Nutrition and Lab Considerations

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- Characterized by metabolic disturbances (hypophosphatemia, hypokalemia, and hypomagnesemia) after resuming nutrition in severely malnourished patients.
- Highest risk in IUGR & SGA infants (even if AGA at birth, including infants of mother's with placental insufficiency, PIH)
- The more severe the IUGR, the greater the risk of electrolyte abnormalities.
- *Early, aggressive parenteral nutrition sets the stage for ALL ELBW & VLBW infants to show metabolic disturbances consistent with or similar to RFS.*

Clinical Consequences of Hypophosphatemia:

- Respiratory failure (diaphragm weakness) – VLBW neonates with hypophosphatemia were significantly more likely to require mechanical ventilation for ≥ 3 days.
- Hemolysis, leukocyte dysfunction, thrombocytopenia, decreased O₂ delivery.
- Neuromuscular dysfunction with weakness and paresthesia
- Ileus/delayed gut motility – delayed advancement of enteral feedings

Clinical Symptoms of Hypokalemia:

- Arrhythmia/cardiac arrest –not reported or observed in neonatal population
- Neuromuscular dysfunction with weakness and paresthesia
- Ileus/delayed gut motility – delayed advancement of enteral feedings

Clinical Symptoms of Hypomagnesemia:

- Weakness, tremors, seizures, delayed gut motility
- May induce hypokalemia by impairing Na/K ATPase
- May induce hypocalcemia by impairment of parathyroid function
- Arrhythmia possible

Clinical Consequences of Hyperglycemia:

- Hyperosmotic state\dehydration from excessive UOP
- Possible increased infectious risk from impaired neutrophil function

Management Guidelines for Abnormally Low Electrolyte Values:

	Indication	Standard NICU Replacement Dose
Hyponatremia	<120 mmol/L	Consider replacement with D5NS or 3% sodium chloride (MUST calculate Na deficit, consider Gomella Hyponatremia chapter for reference. Use extreme caution if using 3% NaCl for correction. Correction should occur SLOWLY, at a rate of approximately 1mmol/L per hour.)
Hypokalemia	<3 mmol/L	KCl 1mEq/kg/dose IV
Hypocalcemia	Ionized Ca <0.9 mmol/L	Calcium Gluconate 200mg/kg/dose
Hypophosphatemia	<3 mg/dl	NaPhos 0.3 mmol/kg/dose
Hypomagnesemia	<1 mg/dl	Magnesium sulfate 50mg/kg/dose

Management Guidelines for Abnormally Elevated Electrolyte Values:

Hypernatremia	<ul style="list-style-type: none"> • Increase TPN if glucose/protein concentrations allow • Add additional fluid source as needed • Do not increase UAC fluids to greater than 1ml/hr • Consider NG/OG sterile water infusion if hypernatremia is persistent or severe
Hyperkalemia	<ul style="list-style-type: none"> • If K >7mg/dl, repeat lab value to confirm and consider intervention • If intervention needed the following may be used: <ul style="list-style-type: none"> ○ Albuterol nebs or MDIs ○ IV Calcium Gluconate ○ IV Furosemide ○ IV Bicarbonate ○ IV or SQ Insulin (ensure adequate glucose infusion)
Hypercalcemia	<ul style="list-style-type: none"> • If asymptomatic but total Calcium >12mg/dl, check ionized Calcium and Phosphorus • If ionized Calcium >1.5 mmol/L, consider intervention • If intervention needed, consider 20ml/kg Normal Saline bolus followed by IV or PO furosemide
Hypermagnesemia	<ul style="list-style-type: none"> • Obtain Mg level at 24hrs if mother received magnesium therapy prenatally <ul style="list-style-type: none"> ○ If level >3mg/dl, hold Magnesium out of TPN for 72 hrs then add back in as standard panel value ○ If level <3mg/dl, use standard panel in TPN starting on DOL 2

TPN Guidelines for Known or Suspected RFS (<28 wks or <1000 grams):

DOL	Total Fluids (ml/k/d)	SPN/custom	GIR	AA Only (g/kg)	Lipids (g/k/d)	Electrolytes	Special considerations	Labs for following day (AM draw)	Phosphorus Initially serum levels are likely normal despite intracellular depletion.
<i>first 24 hrs</i>	100-120 ml/kg	SPN 80-100 ml/kg	4-5	2.8-3.5 Only restrict AA if no phos in PN	NA	Consider Ca 1-2mEq/kg/d	Advance kcal only \leq 5-10 kcal/kg/day. Must give phos to adv GIR or kcals Risk for hypoglycemia in 1 st 24-48h then hyperglycemia	BMP, Phos, Mg	Abn <4 Severely low <2.5 Replace with NaPhos for <3 Add to PN for Phos 3-4
1	100-120 ml/kg <i>Continue trophic feeds or start FAT</i>	CUSTOM	Adv by 0.5-1 <i>Hold adv If Phos <3 and/or BG > 150</i>	3-3.5	0.5gm/k/d Adv by 0.5gm/k/d	Provide Phos and K in PN. Mg if no maternal MgSO4 Ca:Phos ratio (0.8:1 molar) Phos: 1-1.6 mMol/kg K: 1 mEq/kg (prefer K, if +UOP) Restrict Na (0-1)	Hypokalemia 1 st sign of RFS give KCl bolus if <2.5mg/dl Hypomagnesemia <1.5mg/dl Low magnesium may prevent adequate repletion of K & Phos	POCT Chem 8	Phos <3.5, daily monitoring while nutrition advances until Phos >4.5, then repeat in 2-3 days or once on "full-nutrition/feeds" to ensure Phos >5.
2	120-140 ml/kg <i>Trophic feeds</i>	CUSTOM	Same as above	3-3.5	1	Same	Hyperinsulinemia causing Na and fluid retention	POCT Chem 8	
3	120-140 ml/kg <i>Trophic feeds</i>	CUSTOM	Same as above	3-3.5	1.5	Same or liberalize Na/K	*Reminder: adv total kcals by only 5-10 kcal/kg/day if showing RFS. *Or hold kcal adv if Phos < 3.5.	POCT Chem 8, Phos, Mg	
4	140-150 ml/kg	CUSTOM	Same as above	3-4	2	Ca:Phos 0.8:1 Liberalize Na/K		POCT Chem 8	
5	150-160 ml/kg	CUSTOM	Same as above	3-4	2.5	Ca:Phos 0.8:1 Liberalize Na/K			
6	150-160 ml/kg	CUSTOM	Same as above	4	3	Ca:Phos 0.8:1 Liberalize Na/K		POCT Chem 8 Phos, Mg	Repeat in 2-3 days or when on full feeds. Goal >5
7	150-165 ml/kg	CUSTOM	GIR↓ as feeds ↑	3.8-4	3	Ca:Phos 1:1 if phos > 5 Otherwise 0.8:1		BMP	
8	150-165 ml/kg	CUSTOM	GIR↓ as feeds ↑	2.8-3	↓ lipids** as feeds ↑	Same		BMP/POCT Chem 8 PRN	
9	150-170 ml/kg	CUSTOM	GIR↓ as feeds ↑	1.5-1.8	↓ lipids** as feeds ↑	Same		BMP/POCT Chem 8 PRN	
10	150-170 ml/kg	SPN D10%	2.5-4 as nearly full feeds	0.8-1.5	D/C	Consider custom PN if high Na/OAC reqmt or oral Na		BMP, Phos 5-7 days off PN	

****As feeds increase, total fat intake as combo of IL + feeds acceptable up to 5.5 g/kg/day short-term.**