



American Society for Parenteral  
and Enteral Nutrition

## Parenteral Nutrition Electrolyte / Mineral Product Shortage Considerations

There is a growing and critical shortage of **electrolyte and mineral injections** needed for parenteral nutrition. We have heard from many consumer groups, healthcare systems, and clinicians regarding their short supplies or inability to obtain these products. The seriousness of this shortage has the potential to be similar to that of intravenous (IV) multivitamins, which resulted in significant complications and some deaths.

While there are no replacements for concentrated electrolyte and mineral injections, dose conservation or alternate therapy measures can be taken. The American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.) has developed conservation recommendations and alternate therapy measures in order to cope with the shortages. If the shortage persists, patients will go untreated, have electrolyte/mineral imbalances, or may be withdrawn from required parenteral nutrition therapy. We consider the lack of electrolyte and mineral injections to be a very serious health issue for patients requiring parenteral nutrition in the U.S. The U.S. Food and Drug Administration Drug Shortage Program is working very hard to try to resolve these issues.

During the product shortage period, consider one or more of the following measures:

1. Assess each patient as to the indication for parenteral nutrition (PN).
2. Consider providing nutrition and/or medications via the oral or enteral route when possible.
3. Purchase only as much electrolyte and mineral injections supply as needed. In the interest of fair allocation to all patients nationally, please do not stockpile.
4. Consider prioritizing patients, saving supply for those vulnerable populations such as neonatal, pediatric or short bowel or malabsorption syndromes PN groups.
5. Eliminate the use of parenteral electrolyte / mineral injections as a supplemental additive in enteral nutrition products.
6. Minimize the use of electrolyte / mineral additives in IV fluids.
7. Reconsider the use of serum electrolyte algorithms / protocols as "automatic" IV electrolyte replacement therapies in otherwise asymptomatic patients.
8. Use oral or enteral electrolyte / mineral products as much as possible for replacement therapy. Consult a pharmacist for alternative product information.
9. Use premixed, IV electrolyte / mineral products as much as possible for replacement therapy.
10. Review the entire portfolio of parenteral nutrition products available nationally. There may be a shortage in one concentration or salt form but availability in another form.

11. Assess your PN patient population to determine if a standardized, commercial parenteral nutrition product with standard electrolytes<sup>1</sup> (AKA, "premix" PN) might be appropriate for a portion of your patient population. You can generally add additional components to these products.
12. Assess your PN patient population to determine if a standardized, commercial multi-electrolyte product might be appropriate for a portion of your PN patient population.
13. Consider compounding PN in a single, central location (either in a centralized pharmacy or as outsourced preparation) in order to decrease inventory waste.
14. Consider decreasing or eliminating the daily amount of electrolyte added to the PN.
15. Monitor serum electrolyte concentrations closely.
16. Observe for an increase in deficiencies with the ongoing shortages. Increase your awareness and assessment for signs and symptoms of electrolyte and mineral deficiencies.
17. Facilities and practitioners need to continue to observe and be compliant with the product labeling (e.g., package insert), USP General Chapter <797> Pharmaceutical Compounding-Sterile Preparations, and state Boards of Pharmacy rules and regulations.
18. **Report severe drug product shortage information to the FDA Drug Shortage Program (DSP).** See: <http://www.fda.gov/Drugs/DrugSafety/DrugShortages/ucm142398.htm>
19. **Report any patient problems related to shortages to ISMP Medication Errors Reporting Program (MERP).** To access that reporting mechanism: [http://www.nutritioncare.org/Professional\\_Resources/Patient\\_Safety/ISMP\\_Project/](http://www.nutritioncare.org/Professional_Resources/Patient_Safety/ISMP_Project/)

Consider one or more of the following measures for managing each electrolyte and mineral shortage and their related signs and symptoms of deficiencies:

#### **IV Concentrated Calcium Shortage:**

1. If calcium gluconate is removed from the PN formulation monitor serum calcium concentrations along with albumin or preferably ionized calcium concentrations.
2. If intravenous calcium is necessary, administer calcium chloride as a separate infusion from the PN.
3. Consider multi-electrolyte products that contain calcium for addition to PN.
4. Consider standardized, commercial PN products that contain calcium.
5. Calcium gluconate is the preferred form of calcium used in multicomponent PN. It is important to note that PN solubility curves for calcium gluconate cannot be applied to calcium chloride. The quantitative amount of calcium to add as calcium chloride to a PN formulation that contains phosphate is VERY limited. To our knowledge, the only published evidence is from *AJHP* 1980:37;673-4<sup>2</sup>. This relates to the comparative amount of calcium as gluconate vs. chloride in a dextrose / amino acid (2-in-1) PN formulation. Based on this limited data, we would not recommend exceeding concentrations of 5 mEq/L of calcium (as chloride) and the PN must have a phosphate concentration of 15 mmol/L of phosphate or less and the amino acids must be 4.25% or greater in a dextrose / amino acid (2-in-1) PN formulation. There is no published information on calcium-phosphate solubility in a dextrose / amino acid / fat (3-in-1) PN formulation using calcium chloride.
6. Signs and symptoms of calcium deficiency: tetany, other neuromuscular, CNS and cardiovascular symptoms.<sup>3</sup>

#### **IV Concentrated Phosphate Shortage:**

1. Consider using the alternate salt IV phosphate as available and balance the sodium and potassium accordingly.
2. Consider oral or enteral phosphate products/supplements to replete or maintain serum phosphorus concentrations.

3. Consider commercially available standardized, commercial PN products that contain phosphate.
4. Decrease the daily amount/dose of phosphate added to PN formulations.
5. Reserve phosphates for pediatric and neonatal patients requiring PN.
6. Reserve phosphates for those patients with a therapeutic medical need for phosphorus.
7. Consider provision of daily IV fat emulsion to all PN patients as clinically appropriate. Note: IV fat emulsions contain 15 mmol/L of phosphate as egg phospholipids.
8. Signs and symptoms of phosphorus deficiency: impaired diaphragmatic contractility, respiratory failure, tissue hypoxia, decreased myocardial contractility, paralysis, weakness, paresthesias, neurologic dysfunction, seizures, death.<sup>3</sup>

#### **IV Concentrated Sodium Shortage:**

1. Consider using alternate IV sodium salts and concentrations as available and balance the chloride, acetate and phosphate accordingly.
2. Consider administering IV medications in 0.9% sodium chloride (normal saline) instead of 5% dextrose in water (D<sub>5</sub>W) when compatible.
3. Consider changing/increasing the sodium concentration of IV fluids (0.45% to 0.9% sodium chloride)
4. Consider using 0.9% sodium chloride (normal saline) for irrigation with enteral nutrition when patients are on both enteral and parenteral therapy.
5. Signs and symptoms of sodium deficiency: headache, lethargy, disorientation, restlessness, nausea, vomiting, muscle cramps or weakness, depressed reflexes, seizures, coma, and death.<sup>3</sup>

#### **IV Concentrated Potassium Shortage:**

1. Consider using alternate IV potassium salts as available and balance the chloride, acetate and phosphate accordingly.
2. Consider oral or enteral potassium products/supplements to replete or maintain serum potassium levels
3. Use premixed, intravenous potassium products as much as possible for IV maintenance / replacement therapy. Minimize the use of IV potassium additives in IV fluids.
4. Signs and symptoms of potassium deficiency: nausea, vomiting, weakness, constipation, EKG changes, cardiac arrhythmias, sudden death, paralysis, respiratory compromise, and rhabdomyolysis,<sup>3</sup>

#### **IV Concentrated Magnesium Shortage:**

1. Use premixed, intravenous magnesium products as much as possible for IV maintenance / replacement therapy.
2. Minimize the use of IV magnesium additives in IV fluids.
3. Signs and symptoms of magnesium deficiency: ECG changes, arrhythmias, seizures, coma, and death.<sup>3</sup>

References:

1. A.S.P.E.N. Board of Directors and Task Force on Parenteral Nutrition Standardization: Kochevar M, Guenter P, Holcombe B, Malone A, Mirtallo J. A.S.P.E.N. statement on parenteral nutrition standardization. *JPEN J Parenter Enteral Nutr* 2007; 31(5):441–448.
2. Henry RS, et al. Compatibility of calcium chloride and calcium gluconate with sodium phosphate in a mixed TPN solution. *Am J Hosp Pharm* 1980; 37:673-4.
3. Kraft M, et al. Treatment of electrolyte disorders in adult patients in the intensive care unit. *Am J Health-Syst Pharm*. 2005; 62:1663-82

**Important Note:** These recommendations do not constitute medical or professional advice, and should not be taken as such. To the extent the information published herein may be used to assist in the care of patients, this is the result of the sole professional judgment of the attending health professional whose judgment is the primary component of quality medical care. The information presented herein is not a substitute for the exercise of such judgment by the health professional.

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