

TABLE 36-3.

Common Sterile Components and Concentrations of Nutrients Used in Compounding Total Parenteral Nutrition Admixtures

<i>Additive</i>	<i>Concentration(s)</i>
Conventional crystalline amino acids	10% to 15%
BCAA	7%
Dextrose	50% to 70%
Lipid emulsion	20%
Sodium chloride	4 mEq/mL
Sodium acetate	2 mEq/mL
Sodium phosphates	4 mEq of sodium + 3 mmol phosphate/mL
Potassium chloride	2 mEq/mL
Potassium acetate	2 mEq/mL
Calcium gluconate	0.465 mEq/mL
Magnesium sulfate	4.05 mEq/mL
Trace minerals—5 (per 3 mL)	
Chromium	12 µg
Copper	1.2 mg
Manganese	0.3 mg
Selenium	60 µg
Zinc	3 mg
Parenteral multivitamins (per 10 mL)	
Retinol*	1 mg
Ergocalciferol*	5 µg
α-tocopherol*	10 mg
Phylloquinone*	150 µg
Ascorbic acid†	200 mg
Folic acid†	600 µg
Niacin†	40 mg
Riboflavin†	3.6 mg
Thiamine†	6 mg
Pyridoxine†	6 mg
Cyanocobalamin†	5 µg
Pantothenic acid†	15 mg
Biotin†	60 µg

* fat-soluble vitamins
† water-soluble vitamins
BCAA = branched-chain amino acid

Parenteral Nutrition Stability and Compatibility

The stability of PN admixtures is complex, given the number of components present in a typical formulation. For example, there are 15 to 20 crystalline amino acids, dextrose, 10 to 12 electrolyte salts, 12 to 13 vitamins, 5 to 7 trace minerals, and possibly lipid emulsion and drugs. Combined, there are 50 or more individual chemical entities that compose a PN admixture. Degradation processes most commonly encountered include those involving oxidation, hydrolysis, and emulsion breakdown.

One of the most significant examples of instability that may be encountered in PN admixtures includes destabilization of lipid emulsion when included in a formulation, forming a 3-in-1 or total nutrient admixture (TNA). There

are many benefits associated with TNA therapy compared to the separate administration of lipid emulsions, such as reduced infectious risk, related to both the formulation and elimination of separate administration sets and/or peripheral catheters; improved metabolic utilization of lipid emulsions when given over 24 hours versus 12 hours or less; and cost effectiveness. However, if the composition of the TNA formulation is pushed beyond the limits imposed by the manufacturer—whether it results from excess cations (sodium, potassium, and especially calcium and magnesium), excessively long beyond-use date assignments by the compounding pharmacist, or poor storage conditions—the emulsified submicron droplets can coalesce, forming large fat globules in excess of 1 µm. When these globules reach a dimension of 5 µm or more, they are capable of obstructing the vessels of the microvasculature and, if infused in sufficient quantities, can lead