

Multi-Chamber Bag Parenteral Nutrition: Indications, Product Availability, and Patient Safety



Commercially available multi-chamber bag parenteral nutrition (MCB-PN) products have recently seen an increase in use in the United States due to reduced staff time required for its preparation and, in part, due to recent PN product shortages.^{1,2} ASPEN defines MCB-PN as standardized, commercially available parenteral nutrition (PN) formulations from a manufacturer. These products require fewer compounding steps before administration. The term “premixed” should be avoided as bag activation and additives are required. This practice tool reviews indications for MCB-PN, current MCB-PN products available in the US, and safety considerations related to their use.

Indications

MCB-PN can be used in many patients who require PN. Until recently, these products have had limited utility in patients requiring higher amounts of protein and calories, but newer formulations have somewhat bridged this gap. MCB-PN has also had some limited utility in patients with fluid and electrolyte abnormalities. Institutions and home infusion providers should consider patient acuity and the potential utility of MCB-PN products when adding the products to their formularies. MCB-PN is more often used in smaller hospitals and in those with fewer than five PN prescriptions per day.³⁻⁵

US Product Availability

In the United States, MCB-PN products are available as two- and three-chamber bags.^{6,7} Two MCB-PN product lines are available and vary in osmolarity, which can allow for central or peripheral venous administration.

- A two-chamber MCB-PN product contains dextrose and amino acid in two separate chambers. These bags also have capacity to add an additional 1000 mL of ingredients, including lipid injectable emulsions (ILEs). These MCB-PN products also come with and without electrolytes.⁶
- A three-chamber MCB-PN product contains lipid injectable emulsion (ILE), dextrose, and amino acid, each in separate chambers. Currently, the three-chamber product does not have an electrolyte-free version, and the ILE chamber contains soybean oil-based ILE.⁷

Baxter Products and Rate Chart

- [Clinimix/Clinimix E Products](#)
- [Clinimix/Clinimix E Macronutrient and Micronutrient Rate Chart](#)

2-Chamber Product



Fresenius-Kabi Products and Rate Chart

- [Kabiven/Perikabiven Products](#)
- [Kabiven Macronutrient and Micronutrient Rate Chart](#)

3-Chamber Product



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Comparison of Available MCB-PN Products

Characteristics	2-Chamber MCB-PN	3-Chamber MCB-PN
Chamber ingredients	Dextrose and amino acid	Dextrose, amino acid, and ILE
Volume	1,000 and 2,000 mL	1026 mL, 1440 mL, 1540 mL, 1920 mL, 2053 mL, 2566 mL
Electrolyte options and concentrations	With or without electrolytes Similar electrolytes per liter	With electrolytes Similar electrolytes per liter

Macronutrient Concentrations and Dose	2-Chamber MCB-PN	3-Chamber MCB-PN
Amino acid concentration after mixing	2.75%-8%	2.36%- 3.31%
Amino acid dose (grams per liter)	27.5-80	23-33
Dextrose concentration after mixing	5%-20%	7.5%-10.8%
Dextrose dose (grams per liter)	50-200	75-108
ILE concentration	ILE not included	3.5-3.9%
ILE dose (grams per liter)	0	35-39

ILE, lipid injectable emulsion; MCB-PN, multi-chamber bag parenteral nutrition. See Clinimix composition (ushospitalproducts.baxter.com) and Kabiven and Perikabiven composition (freseniuskabinutrition.com)

Advantages, Disadvantages, and Limitations of MCB-PN

Advantages⁸⁻¹¹

- Reduced risk of prescribing and compounding errors
- Cost advantage including reduced pharmacy preparation time
- Less manipulation and reduced infection rates
- Can be used in times of macronutrient or additive shortages
- Comparable nutrition efficacy
- Emergency preparation

Disadvantages/Limitations¹²

- Limited formulations thus not able to prescribe for all patients
- Those with significant fluid or electrolyte imbalances, high gastrointestinal tract output, or require large amounts of amino acids or electrolytes may not be candidates
- Volume (wastage or multiple bags)
- May require two systems of ordering PN, one for compounded and one for MCB-PN
- Transitions of care may be confusing from a hospital MCB-PN to a home compounded PN
- Not complete PN (still need activation and additives such as micronutrients)

Safety Considerations with MCB-PN^{8,12,13,15,16}

Compounded PN is a complex admixture that may contain up to 40 ingredients and requires the use of an automated compounding device to ensure accuracy.¹³ Because MCB-PN requires less manipulation and admixing than compounded PN, MCB-PN products often are not considered as complex and thus not treated as a high-alert medication. However according to the Institute for Safe Medication Practices (ISMP), compounded PN is a high-alert medication, and MCB-PN should be managed no differently than compounded PN.¹⁴ Institutions should develop policies and procedures as well as conduct extensive educational training to all healthcare disciplines involved in the use of PN when adding MCB-PN to formularies. Home PN patients and caregivers should also receive education on preparation and administration of these products when prescribed. Below find safety considerations and recommendations concerning MCB-PN.

Safety Issues and Practice Recommendations

PN Use Process Step	Safety Issues with MCB-PN	Practice Recommendations
Prescribing/ Order Review	MCB-PN products report macronutrients as percentages and electrolytes per liter. This can cause confusion about the actual amount to prescribe as the ASPEN recommendation is to prescribe in amounts per day.	Important to recognize the amount of each component delivered to the patient. Considerations should be made for how these amounts will be displayed in the order entry process and medication administration records.
	Calcium salt used in MCB-PN is calcium chloride, not calcium gluconate, and this may impact calcium phosphate solubility. Overall, addition of additives that may alter the stability of the MCB-PN.	Require the pharmacy contact manufacturer if making any electrolyte additions to the MCB-PN to review stability data. Make this information available to prescribers, pharmacists, nurses, and dietitians.
	Errors in transitions of care caused by MCB-PN not being prescribed in amounts per day; and inappropriate translation of the MCB-PN formula to a compounded PN formula can lead to transcription and calculation errors.	Work with home infusion pharmacies to convert MCB-PN to patient-specific compounded PN. Safeguards for order transfer and interpretation during transition of care orders must be considered to reduce risk for harm.
	ILE not ordered with use of 2-chamber MCB-PN, leading to essential fatty acid deficiency.	Review order to check for all essential macro- and micronutrients.
Compounding/ Preparation	MCB-PN not activated properly, which could lead to the patient not receiving the prescribed amounts of macronutrients and micronutrients.	Require the pharmacy to activate all MCB-PN bags, mixing the chambers and adding any prescribed additives in a sterile environment. Avoid storing MCB-PN in an ACD.
	Essential components omitted such as multivitamins, trace elements.	Review order and adjust to add all essential macro- and micronutrients.
	Look alike bags between those with electrolytes and those without electrolytes.	Store MCB-PN separately in the pharmacy, away from other similar looking bags. Double check with and without electrolyte products.
	Use in the home environment with inadequate patient/caregiver education.	Provide home PN patients and caregivers education on preparation and administration of MCB-PN products when prescribed.
Labeling	Confusion on MCB-PN bag contents and what is added in the pharmacy as compared to the PN order.	Consider applying auxiliary labels to the MCB-PN bags for nurses to confirm that the product has been activated and has the correct contents prior to administration.
Administration	MCB-PN allowed to hang more than 24 hours, leading to an increased risk for infections.	Establish a maximum timeframe in which MCB-PN should be administered (hang time).
	Insulin delivery if added to bag and bag not fully infused.	Adjust insulin orders to match hang time of the MCB-PN bag so that the patient receives the correct insulin dose.

ACD = automated dispensing cabinet; MCB-PN = multi-chamber bag parenteral nutrition

Decision to Use in Your Institution

It is important to review the following issues and patient profiles to help decide if MCB-PN should be added to the formulary:^{8,12}

- Review the institution size and number of PNs compounded daily.
- Review the types of patients who require PN.
- Do they require fluid restriction? Consider more concentrated products.
- Do they require high protein? Consider products with a wider range of protein options.
- Do they have abnormal electrolyte requirements? Consider carrying products with and without electrolytes.

Conclusion

- MCB-PN use in the US appears to be growing.
- MCB-PN can be safer, less expensive, and useful in shortages.
- MCB-PN has limitations and is not for all patients.
- MCB-PN does not come without safety concerns and the risk for errors.
- Each institution should evaluate whether to use this type of PN.

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