ASPEN
Parenteral Nutrition Handbook
THIRD EDITION

EDITORS

Phil Ayers, PharmD, BCNSP, FASHP
Elizabeth S. Bobo, CNSC, MS, RDN, LDN
Ryan T. Hurt, MD, PhD
Andrew A. Mays, PharmD, BCNSP, CNSC
Patricia H. Worthington, MSN, RN, CNSC
About ASPEN

The American Society for Parenteral and Enteral Nutrition (ASPEN) is a scientific society whose members are healthcare professionals—physicians, dietitians, nurses, pharmacists, other allied health professionals, and researchers—who envision an environment in which every patient receives safe, efficacious, and high-quality patient care.

ASPEN’s mission is to improve patient care by advancing the science and practice of clinical nutrition and metabolism.

NOTE: This publication is designed to provide accurate authoritative information in regard to the subject matter covered. It is sold with the understanding that the publisher is not engaged in rendering medical or other professional advice. Trademarked commercial product names are used only for education purposes and do not constitute endorsement by ASPEN.

This publication does not constitute medical or professional advice, and should not be taken as such. Use of the information published herein is subject to 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.

All rights reserved. No part of this may be used or reproduced in any manner whatsoever without written permission from ASPEN. For information write: American Society for Parenteral and Enteral Nutrition (ASPEN), 8401 Colesville Road, Suite 510, Silver Spring, MD 20910; (301) 587-6315, www.nutritioncare.org, aspen@nutritioncare.org.

# Table of Contents

Preface ............................................................................................................. 1

Editors & Contributors .................................................................................. 2

CHaPteR 1  
**Nutrition Screening, Assessment, and Plan of Care** ........................................... 3

Introduction ........................................................................................................... 3
Malnutrition and Inflammation ............................................................................. 7
Adult Malnutrition Characteristics and Assessment ............................................ 8
General Considerations in Applying the Malnutrition Characteristics .................. 13
Global Perspective on Malnutrition .................................................................. 13
Approach to Pediatric Malnutrition .................................................................. 15
Nutrition Support Care Plan .............................................................................. 19

CHaPteR 2  
**Overview of Parenteral Nutrition** ................................................................. 25

Introduction ........................................................................................................... 25
Routes of Infusion ................................................................................................. 27
Indications for PN ................................................................................................. 29
Specific Indications for PN in Pediatric Patients .................................................. 35
Appropriate Use of PN ......................................................................................... 36
Summary ................................................................................................................ 37

CHaPteR 3  
**Parenteral Nutrition Access Devices** ............................................................ 41

Introduction ........................................................................................................... 41
Physiologic Principles and Vascular Anatomy ....................................................... 44
Nomenclature: Peripheral vs Central Access ....................................................... 45
Peripheral Venous Catheters ................................................................................. 47
Central Venous Access Devices .......................................................................... 48
Assessment for Central Vascular Access ............................................................. 52
Enhancing the Safety of CVAD Insertion and Maintenance ............................... 55
Elements of CVAD Care ....................................................................................... 58
Education and Engagement ............................................................................... 64
Quality Improvement ........................................................................................... 64
# Summary

Parenteral Nutrition Handbook

## CHAPTER 4

**Parenteral Nutrition Formulations and Managing Component Shortages**

- Introduction ................................................. 73
- Formulation Components ................................. 73
- PN Preparation ................................................ 82
- PN Product Shortages ........................................ 84

## CHAPTER 5

**How to Prescribe Parenteral Nutrition Therapy**

- Introduction ...................................................... 95
- PN Order Format ................................................. 97
- General Considerations for Nutrient Requirements .... 104
- Sample Calculations ............................................ 109

## CHAPTER 6

**Review and Verification of Parenteral Nutrition Orders, Preparing Parenteral Nutrition Formulations, and Labeling**

- Introduction ...................................................... 117
- PN Order Review and Verification ......................... 117
- PN Preparation ................................................... 118
- Stability and Compatibility of PN Formulations ........ 127
- Aluminum Contamination .................................... 131
- Labeling PN Formulations .................................... 132

## CHAPTER 7

**Parenteral Nutrition Administration and Monitoring**

- Introduction ...................................................... 141
- Initiating PN ....................................................... 141
- Timing of Nutrition Intervention ......................... 144
- Recognizing Risk for Refeeding Syndrome ............. 145
- Frequency of Errors in Administration Phase of PN .... 146
- System-Based Strategies for Enhancing PN Safety ....... 147
- Quality Improvement ............................................ 151
- Creating a Culture of Safety .................................. 152
- Strategies to Prevent Errors When Initiating a PN Infusion .... 152
## Preventing Errors During PN Administration

- Medication Administration ................................................................. 159
- Monitoring ....................................................................................... 160
- Transitional Feeding and Discontinuing PN ...................................... 164
- Documentation .................................................................................. 166
- Summary ............................................................................................ 166

## CHAPTER 8 Complications of Parenteral Nutrition .................................. 173

### Introduction
- 173

### Macronutrient-Related Complications
- 173

### Micronutrient-Related Complications
- 177

### Refeeding Syndrome
- 179

### Hepatobiliary Complications
- 180

### Strategies to Manage PN-Associated Hepatobiliary Complications
- 184

### Metabolic Bone Disease
- 187

### Summary
- 193

## CHAPTER 9 Competency in Parenteral Nutrition: Prescribing, Order Writing, and Administration .................................................. 199

### Introduction
- 199

### Competencies in PN Prescribing
- 199

### Competencies for PN Order Review and Preparation
- 210

### Competencies for PN Administration
- 217

### Summary
- 229

## CHAPTER 10 Medication-Related Interactions ...................................... 233

### Introduction
- 233

### Pharmaceutical Interactions
- 235

### Pharmacokinetic Interactions
- 241

### Pharmacodynamic Interactions
- 242

### Administration-Related Factors
- 242

### Formula-Related Factors
- 242

### Disease-Related Factors
- 243