

Nutrition in Critical Care

CAMBRIDGE



Nutrition in Critical Care

Edited by

Peter Faber, MD, PhD, FRCA, FFICM

Consultant Cardio-Thoracic Anaesthetist, Department of Cardiac Anaesthesia, Aberdeen Royal Infirmary, Aberdeen, UK

Mario Siervo, MD, MSc, PhD, RPHN

Lecturer in Nutrition and Ageing, Human Nutrition Research Centre, Institute for Ageing and Health, Newcastle University, Newcastle upon Tyne, UK





CAMBRIDGE UNIVERSITY PRESS

University Printing House, Cambridge CB2 8BS, United Kingdom

Published in the United States of America by Cambridge University Press, New York

Cambridge University Press is part of the University of Cambridge.

It furthers the University's mission by disseminating knowledge in the pursuit of education, learning, and research at the highest international levels of excellence.

www.cambridge.org

Information on this title: www.cambridge.org/9781107669017

© Cambridge University Press 2014

This publication is in copyright. Subject to statutory exception and to the provisions of relevant collective licensing agreements, no reproduction of any part may take place without the written permission of Cambridge University Press.

First published 2014

Printed and bound in the United Kingdom by Bell and Bain Ltd

A catalog record for this publication is available from the British Library

Library of Congress Cataloging in Publication data

Nutrition in critical care (Faber)

Nutrition in critical care / edited by Peter Faber, Mario Siervo.

p.; cm

Includes bibliographical references and index.

ISBN 978-1-107-66901-7 (paperback)

I. Faber, Peter, 1969 – editor of compilation. II. Siervo, Mario, editor of compilation. III. Title.

[DNLM: 1. Nutritional Support. 2. Critical Care. WB 410]

RM217

615.8'54-dc23

2013036992

ISBN 978-1-107-66901-7 Paperback

Cambridge University Press has no responsibility for the persistence or accuracy of URLs for external or third-party internet websites referred to in this publication, and does not guarantee that any content on such websites is, or will remain, accurate or appropriate.

Every effort has been made in preparing this book to provide accurate and up to date information which is in accord with accepted standards and practice at the time of publication. Although case histories are drawn from actual cases, every effort has been made to disguise the identities of the individuals involved. Nevertheless, the authors, editors, and publishers can make no warranties that the information contained herein is totally free from error, not least because clinical standards are constantly changing through research and regulation. The authors, editors, and publishers therefore disclaim all liability for direct or consequential damages resulting from the use of material contained in this book. Readers are strongly advised to pay careful attention to information provided by the manufacturer of any drugs or equipment that they plan to use.



Contents

List of contributors Preface		page viii xiii	
Secti	on 1. General Concepts		
1.	Nutritional physiology of the critically ill patient David C. Frankenfield	1	
2.	Nutritional assessment of the critically ill patient Mario Siervo and Carla Prado	13	
3.	Body composition assessment of the critically ill patient Ying Ji and Dympna Gallagher	21	
4.	Micronutrient and vitamin physiology and requirements in critically ill patients Timothy Eden, Minha Rajput-Ray, and Sumantra Ray	33	
Secti	on 2. Nutritional Delivery and Dietetics		
5.	Enteral and parenteral feeding protocols Malissa Warren and Robert Martindale	43	
6.	Commercial nutritional enteral and parenteral formulations in critical care Jonathan A. Silversides, Stephen T. Webb, and Andrew J. Ferguson	53	
7.	Nutritional supplements in critically ill patients Shaul Lev, Ilya Kagan, and Pierre Singer	67	
Secti	on 3. General Problems in Critical Care		
8.	Gastrointestinal disturbances in critically ill patients Andrew M. Hetreed and Peter Faber	73	



•	C
VI	Contents

9.	Fluid and electrolyte management in critical care medicine Nils Siegenthaler, Paolo Merlani, and Andreas Perren	83
10.	Hormonal responses and nutritional management of adults in critical care units John A. Tayek	97
Sect	ion 4. Nutritional Support for Specific Conditions and Pathologies	
11.	Nutritional support of critically ill burn patients Bjarne F. Alsbjoern	109
12.	Nutritional support of critically ill neurosurgical patients Roland N. Dickerson and Peter Faber	117
13.	Nutritional support of critically ill immuno-compromised patients Peter K. Linden	135
14.	Nutritional support of critically ill cancer patients Wilson I. Gonsalves and Aminah Jatoi	147
15.	Nutritional support of critically ill patients after gastrointestinal surgery Shay Nanthakumaran and Jan O. Jansen	155
16.	Nutritional support of critically ill patients with renal failure Patricia Wiesen and Jean-Charles Preiser	163
17.	Nutritional support of critically ill patients with liver and pancreatic failure Euan Thomson and Alistair Lee	175
18.	Nutritional support and implications for critically ill patients with sepsis Michael H. Hooper and Paul E. Marik	187
19.	Nutrition in cardiac intensive care Peter McCanny, Danny Collins, and Andrew A. Klein	199
20.	Nutritional support of critically ill patients with respiratory disorders	211



		Contents	vii
21.	Nutritional support of critically ill organ transplantation patients Andrew J. Kerwin and Michael S. Nussbaum	221	
22.	Nutritional management of anorexia in critical care Maria Gabriella Gentile	229	
23.	Nutritional support of critically ill obese patients Dong Wook Kim and Caroline M. Apovian	237	
Index		243	



List of contributors

BJARNE F. ALSBJOERN, MD, DMSCI

Consultant Surgeon, Director of Burns Unit, Copenhagen University Hospital, Copenhagen East, Denmark

CAROLINE M. APOVIAN, MD

Professor of Medicine, Boston University School of Medicine, Nutrition and Weight Management Center, Boston, MA, USA

DANNY COLLINS

Department of Anaesthesia, Papworth Hospital, Papworth Everard, Cambridge, UK

ROLAND N. DICKERSON, PHARMD, BCNSP, FACN, FCCP, FASHP, FCCM Professor of Clinical Pharmacy, University of Tennessee Health Science Center, and Clinical Coordinator and Clinical Pharmacist, Nutrition Support Service, Regional Medical Center at Memphis, Memphis, TN, USA

TIMOTHY EDEN

Great Western Hospitals NHS Foundation Trust, Swindon; Medical Research Council Human Nutrition Research Unit, Cambridge; and The Need for Nutrition Education Programme, c/o British Dietetic Association, Birmingham, UK

PETER FABER, MD, PHD, FRCA, FFICM

Consultant Cardio-Thoracic Anaesthetist, Department of Cardiac Anaesthesia, Aberdeen Royal Infirmary, Aberdeen, UK

ANDREW J. FERGUSON

Consultant in Anaesthesia and Intensive Care Medicine, Craigavon Area Hospital, Northern Ireland, UK

DAVID C. FRANKENFIELD, MS, RD

Chief Clinical Dietitian, Department of Clinical Nutrition, Penn State Milton S. Hershey Medical Center, Hershey, PA, USA

DYMPNA GALLAGHER, EDD

Associate Professor of Nutritional Medicine, Department of Medicine and Institute of Human Nutrition, Columbia University;
Director, Body Composition Unit, New York Obesity and Nutrition Research Center, St. Luke's-Roosevelt Hospital, New York, NY, USA

viii



List of contributors

İΧ

MARIA GABRIELLA GENTILE

Director, Eating Disorders Unit, Niguarda Hospital, Milan, Italy

WILSON I. GONSALVES, MD

Department of Oncology, Mayo Clinic, Rochester, MN, USA

ANDREW M. HETREED, MBBS, BSC, FRCA

Specialist Registrar in Anaesthetics and Intensive Care, Addenbrooke's Hospital, Cambridge, UK

MICHAEL H. HOOPER

Department of Medicine, Division of Pulmonary and Critical Care Medicine, Eastern Virginia Medical School, Norfolk, VA, USA

JAN O. JANSEN

Consultant in General Surgery and Intensive Care Medicine, Aberdeen Royal Infirmary, Aberdeen, UK

AMINAH JATOI, MD

Department of Oncology, Mayo Clinic, Rochester, MN, USA

YING JI, MD

Research Fellow, New York Obesity and Nutrition Research Center, St. Luke's-Roosevelt Hospital, New York, NY, USA

ILYA KAGAN

Department of Intensive Care, Beilinson Hospital, Rabin Medical Center, Sackler School of Medicine, Tel Aviv University, Tel Aviv, Israel

ANDREW J. KERWIN, MD

Associate Professor of Surgery, Division Chief, Acute Care Surgery, Department of Surgery, University of Florida College of Medicine, Jacksonville; and Trauma Medical Director, Shands Jacksonville Medical Center, Jacksonville, FL, USA

DONG WOOK KIM, MD

Instructor of Medicine, Boston University School of Medicine, Nutrition and Weight Management Center, Boston, MA, USA

ANDREW A. KLEIN

Department of Anaesthesia, Papworth Hospital, Papworth Everard, Cambridge, UK

ALISTAIR LEE, FRCA

Consultant in Transplant Anaesthesia and Critical Care, Department of Anaesthesia, Critical Care & Pain Medicine, Royal Infirmary of Edinburgh, Edinburgh, UK

SHAUL LEV

Department of Intensive Care, Beilinson Hospital, Rabin Medical Center, Sackler School of Medicine, Tel Aviv University, Tel Aviv, Israel



x List of contributors

PETER K. LINDEN, MD

Professor of Medicine and Critical Care Medicine, Temple University School of Medicine, Allegheny General Hospital, Pittsburgh, PA, USA

PAUL E. MARIK

Department of Medicine, Division of Pulmonary and Critical Care Medicine, Eastern Virginia Medical School, Norfolk, VA, USA

ROBERT MARTINDALE, MD, PHD, FACS

Chief, General Surgery Division, Oregon Health Sciences University, Portland, OR, USA

PETER McCANNY

Department of Anaesthesia and Intensive Care, Saint James Hospital, Dublin, Ireland

PAOLO MERLANI

Intensive Care Unit, Geneva University Hospital and University of Geneva, Geneva, Switzerland

SHAY NANTHAKUMARAN

Consultant Surgeon, Aberdeen Royal Infirmary, Aberdeen, UK

MICHAEL S. NUSSBAUM, MD

Professor and Chair, Department of Surgery, University of Florida College of Medicine, Jacksonville, and Surgeon-in-Chief, Shands Jacksonville Medical Center, Jacksonville, FL, USA

ANDREAS PERREN

Intensive Care Unit, Ospedale Regionale Bellinzona e Valli, Bellinzona, Switzerland

CARLA PRADO

Department of Nutrition, Food and Exercise Sciences, College of Human Sciences, The Florida State University, Tallahassee, FL, USA

JEAN-CHARLES PREISER, MD, PHD

Department of Intensive Care, Erasme University Hospital, Brussels, Belgium

MINHA RAJPUT-RAY

Cambridge University Hospitals NHS Foundation Trust, Cambridge; Medical Research Council Human Nutrition Research Unit, Cambridge; and The Need for Nutrition Education Programme, c/o British Dietetic Association, Birmingham, UK

SUMANTRA RAY

Cambridge University Hospitals NHS Foundation Trust, Cambridge; Medical Research Council Human Nutrition Research Unit, Cambridge; and The Need for Nutrition Education Programme, c/o British Dietetic Association, Birmingham, UK



List of contributors

χi

NILS SIEGENTHALER

Intensive Care Unit, Geneva University Hospital and University of Geneva, Geneva, Switzerland

MARIO SIERVO, MD, MSC, PHD, RPHN

Lecturer in Nutrition and Ageing, Human Nutrition Research Centre, Institute for Ageing and Health, Newcastle University, Newcastle upon Tyne, UK

JONATHAN A. SILVERSIDES

Clinical Fellow in Critical Care Medicine, Toronto General Hospital, Toronto, Canada

PIERRE SINGER

Department of Intensive Care, Beilinson Hospital, Rabin Medical Center, Sackler School of Medicine, Tel Aviv University, Tel Aviv, Israel

JOHN A. TAYEK, MD, FACP, FACN

Professor of Medicine – In Residence, David Geffen School of Medicine, Harbor-UCLA Medical Center, Torrance, CA, USA

EUAN THOMSON, MRCP, FRCA

Consultant Anaesthetist, Department of Anaesthesia, Critical Care & Pain Medicine, Royal Infirmary of Edinburgh, Edinburgh, UK

KRISTA L. TURNER, MD, FACS

Assistant Professor, Department of Surgery, The Methodist Hospital, Weill Cornell Medical College, Houston, TX, USA

MALISSA WARREN, RD, CNSC

Portland VA Medical Center, Portland, OR, USA

STEPHEN T. WEBB

Consultant in Cardiothoracic Anaesthesia and Intensive Care Medicine, Papworth Hospital, Papworth Everard, Cambridge, UK

PATRICIA WIESEN, MD

Department of General Intensive Care, University Hospital Center of Liege, Liege, Belgium

CAMBRIDGE



Preface

Nutritional sciences have rapidly expanded within the last few decades with an increasing amount of studies available to guide best evidence practice. Nutrition and the effects of too little, too much, and not the right composition are publicly discussed almost daily amongst the press and politicians. Everybody appears to have an opinion when it comes to the benefits and damages to human health by either the right or wrong diet. Unfortunately, many of these views are carried over into professional healthcare in hospitals where the nutritional support of patients often does not receive adequate attention. Technological and medicinal development in patient care may often result in the nutritional needs of patients being pushed down the list of priorities. Additionally, a lack of personal scientific knowledge of nutrition may result in many clinicians and healthcare workers steering clear of engaging with the nutritional requirements of patients and the benefits optimal diets offer to patient care. No more so is this true than within the critical care environment. Frequently, nutritional assessment and management is not comprehensively integrated into overall patient care. Fortunately, due to the increasing public interest in health and nutrition many clinicians are now starting to engage with nutritional sciences as a tool to improve patient care and prognosis.

The editors of this book have assembled contributions from internationally recognized authors to assist healthcare professionals working within the critical care environment in implementing current best evidence in nutritional support of patients. With this book, it is the hope of the editors not only to provide nutritional support guidelines for the various group of patients admitted to the Critical Care Unit, but also to allow a basic scientific knowledge aiding clinical discussions and decisions. This book should prove useful to those studying nutrition in critical care, but it may also provide an accessible guide for the resident to assist with the nutritional assessment of patients and therapeutic strategies. The book is aimed at doctors, nurses, dieticians, and practitioners working within the critical care environment.

The editors would like to thank all the contributing authors. Without their time and dedication this book would not have happened. We would also like to thank Cambridge University Press, and especially Joanna Chamberlin and Nisha Doshi, for accepting this project and assisting us in getting it completed.

xiii