

Acute Care



of the

Cancer Patient


Andrew D. Shaw

Bernhard J. Riedel

Allen W. Burton

Alan I. Fields

Thomas W. Feeley

Acute Care  **of the** **Cancer Patient**

Acute Care

of the

Cancer Patient

Andrew D. Shaw
Bernhard J. Riedel
Allen W. Burton
Alan I. Fields
Thomas W. Feeley

*The University of Texas M.D. Anderson Cancer Center
Houston, Texas, U.S.A.*



Taylor & Francis
Taylor & Francis Group

Boca Raton London New York Singapore

Published in 2005 by
Taylor & Francis Group
6000 Broken Sound Parkway NW, Suite 300
Boca Raton, FL 33487-2742

© 2005 by Taylor & Francis Group, LLC

No claim to original U.S. Government works
Printed in the United States of America on acid-free paper
10 9 8 7 6 5 4 3 2 1

International Standard Book Number-10: 0-8247-2689-8 (Hardcover)
International Standard Book Number-13: 978-0-8247-2689-8 (Hardcover)

This book contains information obtained from authentic and highly regarded sources. Reprinted material is quoted with permission, and sources are indicated. A wide variety of references are listed. Reasonable efforts have been made to publish reliable data and information, but the author and the publisher cannot assume responsibility for the validity of all materials or for the consequences of their use.

No part of this book may be reprinted, reproduced, transmitted, or utilized in any form by any electronic, mechanical, or other means, now known or hereafter invented, including photocopying, microfilming, and recording, or in any information storage or retrieval system, without written permission from the publishers.

For permission to photocopy or use material electronically from this work, please access www.copyright.com (<http://www.copyright.com/>) or contact the Copyright Clearance Center, Inc. (CCC) 222 Rosewood Drive, Danvers, MA 01923, 978-750-8400. CCC is a not-for-profit organization that provides licenses and registration for a variety of users. For organizations that have been granted a photocopy license by the CCC, a separate system of payment has been arranged.

Trademark Notice: Product or corporate names may be trademarks or registered trademarks, and are used only for identification and explanation without intent to infringe.

Library of Congress Cataloging-in-Publication Data

Catalog record is available from the Library of Congress

T&F informa

Taylor & Francis Group is the Academic Division of T&F Informa plc.

Visit the Taylor & Francis Web site at
<http://www.taylorandfrancis.com>

This book is dedicated to the memory of Douglas Carter (1918–1999), a man whose integrity, flexibility and courage typified the qualities of those who would do battle with this dreadful disease. Let no operation be left untried, no drug remain untested and no compassion be spared for those who have no choice but to fight.

Introduction

The M.D. Anderson Cancer Center is a branch of The University of Texas with 1,000 faculty who focus their entire activities on our mission to eliminate cancer. Our integrated programs in patient care, research, education and prevention provide a wealth of knowledge on clinical care, gained partially from the outcome of extensive research and partly from experiences that have been incorporated into our practices.

This knowledge becomes especially important when skilled medical specialists who are not primarily cancer physicians are called upon to participate, and often temporarily lead, in care delivery for a cancer patient. The continuum of care provided by multidisciplinary teams of surgeons, medical oncologists, and radiation oncologists is frequently punctuated by acute episodes requiring these medical specialists to intervene, with both expertise and speed.

Unstable patients, who ordinarily would not be subjected to extensive surgery, must be stabilized and supported as best as possible when surgery is the only alternative for extending life. We deliberately expose patients to aggressive noninvasive treatments that compromise their ability to fight infection, maintain homeostasis, and prevent bleeding. When these types of complications occur, they become life threatening and require expert intervention. Here the cancer

specialist is dependent upon his or her colleague's knowledge of the special problems that often complicate the cancer patient's care.

This book addresses the needs of physician specialists who inevitably become "team members" in the multidisciplinary care of the cancer patient. Most of the chapters focus upon the specialties of internal medicine, anesthesiology, and critical care. The special aspects of caring for pediatric patients and for end-stage cancer patients requiring palliative care are also addressed.

In addition, cancer specialists will find a wealth of information and experience, enabling better anticipation and fulfillment of their patients' needs.

The recommendations presented in this volume are documented from the research literature when available. Equally important, they draw upon the vast experience of internists, anesthesiologists, critical care specialists and oncologists at a major cancer center. In 2004, M.D. Anderson physicians saw over 60,000 cancer patients, including over 24,000 new patients, from all over the USA and worldwide. Over 12,000 patients participated in therapeutic clinical trials. We performed 12,463 surgeries, 250,035 courses of radiation therapy, and had over 750,000 patient visits in our clinics. All 13,000 employees, including faculty

and staff, are striving to improve cancer care and our understanding of this disease.

As our population ages, the incidence of cancer will double, even though the chances for curing individual patients are improving substantially. In my own lifetime, the 5-year disease-free survival rate has nearly doubled to 60 percent. New targeted therapies that hold great promise are under investigation. More and older patients who are symptomatic, even critically ill, will have treatment options that offer the possibility of prolonged life or even cure. The team effort required to sustain these patients will become more difficult, but also more promising. It is this hope for increased curability that motivates oncologists to push forward

with new, aggressive treatments that often require intensive and rapidly responsive supportive care. Thus, acute cancer care is a timely and relevant topic.

I am pleased that the outstanding faculty at M.D. Anderson, together with collaborators from other institutions, have made this excellent book available to all who undertake the care of patients with cancer.

John Mendelsohn, M.D.

President

The University of Texas
M.D. Anderson Cancer Center
Houston, Texas, U.S.A.

Preface

This book has been written in an effort to collect in one place the knowledge and expertise of the many individuals who provide acute medical care for cancer patients while they receive chemotherapy, radiation treatment and/or undergo surgical resection. Over the past five years we have received many “curbside consults” from colleagues and friends in other institutions about how we do certain things or approach difficult oncological problems, all with the theme “there’s no book, so I called to ask.” We have thus attempted to organize the “para-oncological” problems of cancer patients into logical groups, and then provide a contemporaneous account of what the issues are and how they are solved in each author’s unit. We have divided the book into five sections, according to how we deal with these issues on a daily basis. Thus the first section describes the general principles of oncological practice — a primer for the non-specialist. The second section describes the perioperative care of patients undergoing cancer resection surgery, with surgical, anesthesiological and critical care perspectives in most cases. In the third section of the book we address the acute medical problems encountered by cancer patients, with an emphasis on critical care medicine and physiology. Section four deals with pediatric issues, while the final section covers the problems of pain management and palliative care. Each chapter has been written by one or more individuals whom we would trust to care for ourselves or our families, and thus

whose opinions we trust. We feel that this is the ultimate test of faith in any one physician’s skill, and was thus a natural benchmark when deciding whom we would invite to write each chapter. All of our authors have surpassed our expectations, and we think the result is a truly global collection of experience, skill and knowledge that was previously available only on individual cerebral hard drives. Inevitably there are differences in style when a book is written by more than 100 authors; however, we have tried to maintain consistency of philosophy wherever possible.

We hope that this book provides guidance to those who seek it, reassurance to those who are doubtful, and a challenge to those who may choose to do things a different way. It is our view that there are many ways to practice medicine, and not all are suitable in all places, for all patients, and for all physicians. Thus we have tried to emphasize themes, principles and approaches rather than to provide a recipe for every different situation. Please write and let us know what we did badly, so we may improve it next time around.

*Andrew D. Shaw
Bernhard Riedel
Allen W. Burton
Alan I. Fields
Thomas W. Feeley*

Contents

Introduction v

Preface vii

Contributors xxi

1. Cancer Growth, Progression, and Metastasis 1

Jerald J. Killion and Isaiah J. Fidler

- I. Evolution of the Primary Tumor 1
- II. Tumor Angiogenesis 2
- III. Determinants of Metastasis 3
- IV. Implications for Therapy of Cancer 4
- References 6

2. Principles of Clinical Cancer Staging . . . 11

S. Eva Singletary

- I. Introduction 11
- II. Principles of Clinical Cancer Staging Using the TNM System 12
- III. Changes in the TNM-Staging System 13
- IV. Conclusions 15
- References 15

3. Principles of Surgical Cancer Care 17

Janice N. Cormier and Raphael E. Pollock

- I. Introduction 17
- II. Historical Perspective 17
- III. Patient Assessment 18
- IV. Roles for Surgery 19
- V. Reconstruction and Rehabilitation 27
- VI. The Surgical Oncologist 27
- VII. Conclusions 28
- References 28

4. Principles of Chemotherapy 31

Silwan Chedid and Jonathan Trent

- I. Introduction 31
- II. Tumor Growth 31
- III. Chemotherapy and the Cell Cycle 32
- IV. Combination Chemotherapy 32
- V. Dosage Intensity 33

- VI. Drug Resistance 33
- VII. Chemotherapeutic Agents 34
- VIII. Definition of Response 41
- IX. Conclusion 41
- References 41
- 5. Endocrine Evaluation and Management of the Perioperative Cancer Patient 43**
Steven Waguespack, Robert F. Gagel, Mario Maldonado, Rajagopal V. Sekhar, and Ashok Balasubramaian
- I. Introduction 43
- II. Management of the Cancer Patient with Diabetes Mellitus 43
- III. Management of the Cancer Patient with Thyroid Disease 48
- IV. Disorders of the Adrenal Gland 51
- V. Hypercalcemia and Hypocalcemia 55
- VI. Perioperative Management of the Patient with Pituitary Disease 57
- References 65
- 6. Principles of Bioimmunotherapy: Interferon, Interleukins, Growth Factors, Monoclonal Antibodies, Antisense 69**
Yolanda Gutierrez-Puente, Arturo Chavez-Reyes, Saroj Vadhan-Raj, Xinsheng Liao, James L. Murray, and Paula Trahan-Rieger
- I. Introduction 69
- II. Definition and Classification of Biotherapy 70
- III. Biotherapy-Related Side Effects 85
- IV. Conclusions 86
- References 86
- 7. Bone Marrow Transplantation Complications Requiring Therapy in the Intensive Care Unit 93**
Humberto Caldera and James Gajewski
- I. Introduction 93
- II. Outcome of Bone Marrow Transplantation Recipients Requiring Intensive Care 94
- III. Diffuse Alveolar Hemorrhage 94
- IV. Viral Pneumonias 95
- V. Cytomegalovirus Pneumonia 97
- VI. Posterior Reversible Leukoencephalopathy Syndrome (PRES) 98
- VII. Transfusion Issues in Bone Marrow Transplant Recipients 99
- VIII. Thrombotic Thrombocytopenic Purpura (TTP) 99
- IX. Central Venous Catheter-Related Complications 100
- X. Mucositis 101
- References 101
- 8. Palliative Radiotherapy: Clinical and Radiobiologic Considerations 107**
Nora A. Janjan
- I. Introduction 107
- II. Palliative Radiation Techniques 109
- References 137
- 9. Clinical Trials in Oncology: Organization and Oversight 145**
Carleen A. Brunelli and Leonard A. Zwelling
- I. Philosophy and Principles of Clinical Research 145
- II. Institutional Review Boards and the Department of Health and Human Services 146
- III. Scientific Review 148
- IV. Quality Assurance 149
- V. Institutional Culture 151
- VI. Education Programs 152
- VII. Conclusions 153
- References 153
- 10. Clinical Trials in Oncology: Study Design 155**
Lyle D. Broemeling
- I. Introduction 155
- II. Clinical Trial Design 156
- III. Clinical Trials in Anesthesiology and Critical Care 160
- IV. Conclusions 163
- References 163

- 11. Clinical Trials in Oncology:**
Ethical Issues 165
Martin L. Smith, Anne L. Flamm, and Timothy M. Pawlik
 I. Introduction 165
 II. Historical Background 166
 III. The Doctrine and Process of Informed Consent 167
 IV. Study Design, Subject Selection, and Monitoring 169
 V. Research on Terminally Ill Patients 171
 VI. Placebo Controls 172
 VII. Conflicts of Interest 172
 VIII. Conclusion 174
 References 174
- 12. General Principles of Perioperative Medicine: Surgical and Medical Perspectives 177**
Gregory H. Botz and Zdravka Zafirova
 I. Introduction 177
 II. Principles of Medical Management in the Perioperative Period 177
 III. Perioperative Management 179
 References 181
- 13. The Stress Response and Immunomodulation 185**
A. C. Carr and George M. Hall
 I. Background 185
 II. The Stress Response and Immunomodulation 186
 III. The Neuroendocrine Stress Response and Surgery 186
 IV. Insulin Resistance 189
 V. The Cytokine and Acute Phase Responses 190
 VI. Cell-Mediated Immunity 191
 VII. Modulating the Stress Response: Why Bother? 191
 VIII. Anesthetic and Critical Care Perspectives 192
 IX. Surgical Perspectives 194
 References 195
- 14. Inflammation, Coagulation, and Endothelial Dysfunction: Implications in Perioperative Care 201**
Ravi Taneja and Davy C. H. Cheng
 I. Introduction 201
 II. Inflammation 201
 III. Coagulation 204
 IV. Endothelial Dysfunction: A *Chef d'Oeuvre Par Excellence* 206
 V. Therapeutic Interventions 207
 VI. Inflammation and Carcinogenesis 209
 VII. Conclusion 210
 References 210
 Suggested Readings 216
- 15. Perioperative Care of the Immunocompromised Patient 217**
Sandra L. Peake and Dhaval R. Ghelani
 I. Introduction 217
 II. Immunosuppression Associated with Cancer 217
 III. Anesthetic Perspectives 218
 IV. Intensive Care Perspectives 220
 V. Surgical Perspectives 225
 VI. Conclusions 227
 References 227
 Suggested Readings 230
- 16. Anesthesia for the Chronic Pain Patient 231**
Arun Rajagopal and Hemant N. Shah
 I. Introduction 231
 II. Implications for the Anesthesiologist 232
 III. Basic Definitions 232
 IV. Preanesthetic Evaluation 233
 V. Intraoperative Anesthetic Considerations 234
 VI. Postoperative Considerations 236
 VII. Intensive Care Issues 238
 VIII. Clinical Examples 238
 IX. Conclusions 240
 References 240
 Suggested Readings 241

- 17. Preoperative Anesthesia Evaluation . . . 243**
Tayab R. Andrabi and Marc A. Rozner
- I. Introduction/Background 243
 - II. Goals of Preoperative Evaluation 244
 - III. Chemotherapy and Radiation Therapy 246
 - IV. The Cancer Patient with Heart Disease 249
 - V. The Cancer Patient with an Implanted Cardiac Generator 254
 - VI. Summary 255
 - References 255
- 18. Perioperative Management of Brain Tumors 259**
Rashmi N. Muller
- I. Background 259
 - II. Intracranial Dynamics and the Effects of Anesthetics 259
 - III. Epidemiology of Brain Tumors 268
 - IV. Presentation of Patients with Brain Tumors 268
 - V. Diagnosis 271
 - VI. Surgical Principles 272
 - VII. Preoperative Considerations 273
 - VIII. Intraoperative Management 274
 - IX. Emergence 281
 - X. Postoperative Considerations After Craniotomy 282
 - XI. Infratentorial Surgery 285
 - XII. Ventriculoperitoneal Shunting 287
 - XIII. Surgery for Pituitary Tumors 288
 - XIV. Emergency Craniotomy for Brain Tumors 291
 - References 291
- 19. Perioperative Management of Spinal Tumors 299**
Robert J. Bohinski, Laurence D. Rhines, and Ziya Gokaslan
- I. History and Physical Examination 299
 - II. Patient Positioning 300
 - III. Intraoperative Neurologic Monitoring 303
 - IV. Postoperative Neurologic Monitoring 304
 - V. Coagulation Abnormalities/Blood Loss 304
 - VI. Antibiotic Prophylaxis 305
 - VII. Malnutrition 306
 - VIII. Prevention of Thromboembolism 306
 - IX. Pain Control 306
 - References 307
- 20. Perioperative Care of Patients with Head and Neck Cancer 309**
Andrew MacLachlan, David Ferson, Kristen Pytynia, Ed Diaz, N. Nguyen, and W. Botnick
- I. Introduction 309
 - II. Preoperative Evaluation 310
 - III. Intraoperative Management 311
 - IV. Postoperative Care 315
 - V. Conclusion 317
 - References 317
- 21. Perioperative Care for Thoracic Neoplasms in Acute Cancer Medicine 321**
Jay B. Brodsky, John L. Chow, and Jessica S. Donington
- I. Introduction 321
 - II. Anesthesia Perspectives 321
 - III. Intrathoracic Malignancies 325
 - IV. Surgical Perspectives 327
 - V. Critical Care Perspectives 333
 - VI. Conclusions 344
 - References 344
- 22. Anesthetic Management of Cardiac Tumors 363**
Dilip Thakar and Ashish Sinha
- I. Clinical Presentation 363
 - II. Specific Cardiac Tumors 364
 - III. Extracardiac Tumors with Cardiac Involvement 366
 - IV. Diagnostic Methods 368
 - V. Anesthetic Management of Cardiac Tumors 368
 - References 369

- 23. Perioperative Care of Patients with Liver Neoplasms** 371
James F. Arens and Debra L. Kennamer
- I. Portal Venous Embolization 374
 - II. Anesthetic Management 374
 - III. Surgical Management 377
 - IV. Outcome After Liver Resection 379
 - V. Laparoscopic Liver Resection 379
 - VI. Radiofrequency Tissue Ablation 379
 - VII. Percutaneous RFA 380
 - VIII. Complications of Percutaneous RFA 381
 - IX. Laparoscopic RFA 381
 - X. Ethanol Injection Therapy 381
 - XI. Hepatic Artery Infusion 382
 - References 382
- 24. Perioperative Care for Major Abdominal Surgery: Stomach, Pancreas, Small Intestine, Colon, Rectum, Anus** 385
Karen Chen and Peter Hsu
- I. Introduction 385
 - II. Anesthesiologist's Concerns 385
 - III. Surgical Concerns 390
 - IV. Complications/Perioperative Concerns 397
 - V. Conclusions 398
 - References 398
- 25. Perioperative Care of Patients with Endocrine Neoplasms** 407
M. F. M. James and D. M. Dent
- I. Pituitary Tumors 407
 - II. Parathyroid Tumors 412
 - III. Gastroenteropancreatic Tumors 414
 - IV. Surgical Aspects 418
 - V. Pheochromocytoma 420
 - VI. Multiple Endocrine Neoplasia 424
 - VII. Conclusions 425
 - References 425
- 26. Perioperative Care for Breast and Gynecological Neoplasms** 433
Troy S. Browne, Anees Chagpar, Kelly K. Hunt, and Pedro Ramirez
- I. Perioperative Care of Breast Cancer 433
 - II. Perioperative Care of Gynecologic Cancer 442
 - References 450
- 27. Postanesthesia Care for Reconstructive Microvascular Surgery** 455
Michael J. Miller
- I. Principles of Reconstructive Microvascular Surgery 455
 - II. Postanesthesia Care 456
 - III. Summary 463
 - References 463
- 28. Perioperative Care of Patients with Musculoskeletal Neoplasms** 465
Thao P. Bui and Alan W. Yasko
- I. Introduction 465
 - II. General Principles 465
 - III. Anesthesia Perspectives 468
 - IV. Surgical Management 470
 - V. Anesthesia Management 472
 - VI. Intensive Care and Postoperative Perspectives 479
 - VII. Conclusions 479
 - References 480
- 29. Perioperative Care of Intraoperative Chemotherapy and Radiation: Limb and Peritoneal Perfusion Procedures** 485
Richard E. Royal and Paul F. Mansfield
- I. Introduction 485
 - II. Operative Procedures 486
 - III. Intraoperative Issues 489
 - IV. Postoperative Issues 492
 - V. Chemotherapy Specific Complications 494
 - VI. Summary 496
 - References 496

- 30. Anesthesia for the Patient in Remote Diagnostic and Therapeutic Locations 499**
John C. Frenzel
- I. Introduction 499
 - II. Managing Clinical Structure 499
 - III. Site Assessment 500
 - IV. Equipment 500
 - V. Mobile Carts 500
 - VI. Physically Remote Situations 501
 - VII. Communication 501
 - VIII. Documentation Standards 501
 - IX. Preoperative and Postoperative Evaluations 502
 - X. Anesthetic Management 502
 - XI. Sedation 502
 - XII. Deep Sedation 503
 - XIII. General Anesthesia 503
 - XIV. Future Directions and Trends 504
 - XV. Conclusions 504
 - References 504
- 31. Oncologic Emergencies: Pulmonary Embolus, Superior Vena Cava Syndrome, Cardiac Tamponade, and Respiratory Emergencies 505**
Nicole D. Switzer and Arun Rajagopal
- I. Introduction 505
 - II. Pulmonary Embolus 505
 - III. Superior Vena Cava (SVC) Syndrome 508
 - IV. Cardiac Tamponade 510
 - V. Respiratory Emergencies 512
 - References 516
 - Suggested Readings 517
- 32. Transfusion Therapy and the Cancer Patient 519**
Lawrence T. Goodnough and George Despotis
- I. Current Blood Risks 519
 - II. Blood Transfusion 525
 - III. Platelet Transfusions 528
 - IV. Conclusion 531
 - References 531
- 33. Principles of Medical ICU Oncology . . . 537**
Spencer S. Kee
- I. Introduction 537
 - II. Anesthesia Team Perspective 538
 - III. Oncology Team Perspective 539
 - IV. Intensive Care Team Perspective 540
 - V. Conclusions 541
 - References 541
- 34. Delirium and Substance Withdrawal . . 545**
Alan D. Valentine and Jacqueline Bickham
- I. Introduction 545
 - II. Prevalence 546
 - III. Clinical Presentations of Delirium 546
 - IV. Causes of Delirium 547
 - V. Assessment of Delirium 548
 - VI. Management 549
 - VII. Substance Withdrawal 551
 - References 554
- 35. Neutropenia and Sepsis in Cancer Patients 559**
Kenneth V. I. Rolston and Edward B. Rubenstein
- I. Introduction 559
 - II. Infection in Neutropenic Patients 559
 - III. Infections in Non-Neutropenic Patients 561
 - IV. Device-Related Infections 563
 - V. Special Considerations 564
 - VI. Summary 565
 - References 565
- 36. Acute Coronary Syndrome in Cancer Patients 567**
S. Wamique Yusuf and Edward T. H. Yeh
- I. Introduction/Background 567
 - II. Acute Coronary Syndrome 568
 - III. Etiology of ACS in Cancer Patients 568
 - IV. Presentation 569
 - V. Risk Stratification 569

- VI. Examination 569
 - VII. Investigations 569
 - VIII. Special Problems in Cancer Patients 571
 - IX. Complications of Myocardial Infarction 572
 - X. Ventricular Fibrillation 573
 - XI. Prophylaxis 573
 - XII. Treatment 573
 - XIII. Ventricular Tachycardia 573
 - XIV. Management Strategies for Ventricular Tachycardia 574
 - XV. Heart Failure and Low-Output Syndromes 574
 - XVI. Management of Right Ventricular Ischemia/Infarction 575
 - XVII. Mechanical Defects After Acute Myocardial Infarction 575
 - References 576
- 37. Critical Care of the Cancer Patient with Pulmonary Infiltrates 579**
Vickie R. Shannon and Burton F. Dickey
- I. Introduction 579
 - II. Infectious Pulmonary Complications Among Critically Ill Patients with Cancer 580
 - III. Noninfectious Pulmonary Complications Among Critically Ill Patients with Cancer 608
 - IV. Summary 650
 - References 650
- 38. Acute Renal Failure 669**
John R. Foringer, Andrew D. Shaw, and Kevin W. Finkel
- I. Defining Acute Renal Failure 669
 - II. Evaluation of Acute Renal Failure 670
 - III. Classification of Acute Renal Failure 671
 - IV. Obstructive (Postrenal) Nephropathy 674
 - V. Intrinsic Acute Renal Failure 676
 - VI. Tubulointerstitial Nephritis 681
 - VII. Acute Renal Failure Associated with Lymphoma and Leukemia 685
 - VIII. Radiation Nephritis 685
 - IX. Prevention of Acute Tubular Necrosis 686
 - X. Treatment of Acute Tubular Necrosis 687
 - XI. Renal Replacement Therapy 689
 - References 690
- 39. Complications of Bone Marrow Transplantation and Immunosuppression 697**
Shubhra Ghosh and Daniel R. Couriel
- I. Acute Graft-Versus-Host Disease 697
 - II. Prevention of Acute GvHD 701
 - III. Management of Acute GvHD 701
 - IV. Chronic GvHD 702
 - V. Management of Chronic GvHD 704
 - References 705
- 40. Sedation in the ICU 713**
Lisa E. Connery and Douglas B. Coursin
- I. Patients with Malignancy 714
 - II. The ICU Experience from the Perspective of the Cancer Patient 715
 - III. Terminal Sedation 715
 - IV. Sedation 716
 - V. Anxiety 716
 - VI. Agitation 716
 - VII. Delirium 717
 - VIII. Environment 717
 - IX. Sedation and the Stress Response 718
 - X. The Ideal ICU Sedative 718
 - XI. Goals of Sedation 718
 - XII. Sedation Monitoring 719
 - XIII. Sedation Scales 719
 - XIV. Clinical Sedation Monitoring 719

XV. Subjective Sedation Scales	720	LII. The Future of Intensive Care Sedation	739
XVI. Neuromuscular Blockade	722	References	739
XVII. Objectived Sedation Monitoring	722	41. Cardiovascular Support 743	
XVIII. Auditory Evoked Potentials	723	<i>M. Fanshawe, S. G. Tan, and Jeff Lipman</i>	
XIX. Choice of Sedative	724	I. Introduction	743
XX. SCCM Guidelines for Sedatives	724	II. Hemodynamic Monitoring	744
XXI. Benzodiazepines	724	III. Causes of Circulatory Failure in Oncology Patients	748
XXII. Midazolam	725	IV. Perioperative Optimization	749
XXIII. Lorazepam	727	V. Treatment of Circulatory Failure	750
XXIV. Lorazepam and Propylene Glycol Toxicity	728	VI. Conclusion	753
XXV. Diazepam	728	References	754
XXVI. Flumazenil	728	42. Respiratory Failure and Mechanical Ventilation in Cancer Patients 759	
XXVII. Propofol	729	<i>Todd Kelly</i>	
XXVIII. Comparative Studies	730	I. Etiologies of Respiratory Failure in Cancer Patients	759
XXIX. Propofol and Brain Injury	730	II. Prognosis of Mechanical Ventilation in Cancer Patients	761
XXX. Propofol in Children	730	III. Management of Respiratory Failure	765
XXXI. Dexmedetomidine	731	IV. Weaning	780
XXXII. Pharmacokinetic Properties	731	V. Advanced Ventilation	787
XXXIII. DEX in the ICU	731	VI. Terminal Weaning	790
XXXIV. Haloperidol	732	References	792
XXXV. Protocol for Continuous Infusion of Haloperidol	733	43. Nutrition Support of the ICU Cancer Patient 805	
XXXVI. Other Agents	734	<i>Tami Johnson, Anne Tucker, and Todd Canada</i>	
XXXVII. Etomidate	734	I. Introduction	805
XXXVIII. Barbiturates	734	II. Assessing and Monitoring Nutritional Status	805
XXXIX. Ketamine	734	III. Determination of Energy and Protein Needs	807
XL. Analgesia	735	IV. Enteral Versus Parenteral Nutrition	811
XLI. Opioids	735	V. Nutrition Support in Special Patient Populations	814
XLII. Remifentanil	736	VI. Hepatic Failure	814
XLIII. Fentanyl	736	VII. Renal Failure	818
XLIV. Hydromorphone	736		
XLV. Morphine Sulfate	736		
XLVI. Naloxone	736		
XLVII. Drug Interactions in Cancer Patients	736		
XLVIII. Cost Considerations	737		
XLIX. Post-ICU Depression and Stress Syndromes	737		
L. Withdrawal Syndromes	738		
LI. Removal of Life Support	738		

- VIII. Pulmonary Failure 820
 IX. Summary 822
 References 822
- 44. Nosocomial Infections and Antibiotic Therapy in Patients with Cancer 827**
Amar Safdar and Issam I. Raad
 I. Introduction 827
 II. Bloodstream Infections 830
 III. Pneumonia 835
 References 839
- 45. Critical Care Imaging in Oncology Patients 847**
Chaan S. Ng, Sanjay Singh, and Mylene T. Truong
 I. Comparison of Imaging Modalities 847
 II. Thoracic Imaging 848
 III. Cardiopulmonary Disorders 851
 IV. Abdominopelvic Disorders 858
 V. Central Nervous System Disorders 864
 References 869
- 46. Interventional Radiology in the Oncologic Critical Care Setting 873**
Michael J. Wallace
 I. Introduction 873
 II. Drainage Procedures 873
 III. Arterial Interventions 878
 IV. Venous Interventions 882
 References 885
- 47. Care at the End of Life 891**
C. Lee Parmley
 I. Introduction/Background 891
 II. Planning Terminal Care 893
 III. Decisions in EOL Care 897
 IV. Conflicts over Terminal Care 901
 V. Physician-Assisted Death (PAD) in the United States and Elsewhere 903
 VI. Conclusion 905
 References 905
- 48. Legal Considerations: Liability, Consent, Risk Management, Withdrawing Life Support 909**
I. McLellan and J. Tring
 I. Introduction 909
 II. Liability 909
 III. Consent 910
 IV. Risk Management 913
 V. Withdrawing Life Support 915
 VI. Conclusion 916
 References 916
- 49. Perioperative Care of Children with Cancer: An Overview 919**
Alan I. Fields, Rodrigo Mejia, and James D. Wilkinson
 References 921
- 50. Perioperative Care of Children with Cancer 923**
Kerri J. George and Nancy L. Glass
 I. Introduction 923
 II. Anesthetic Perspectives 924
 III. Preoperative Assessment 932
 IV. Intraoperative Management 936
 V. Postoperative Care 940
 VI. Specific Clinical Cases 941
 VII. Anesthesia Outside the Operating Room 945
 VIII. Do Not Resuscitate Orders and the Terminally ill Child 946
 IX. Chronic Pain in the Pediatric Cancer Patient 946
 X. Conclusion 950
 References 950
- 51. Perioperative Care of Children with Cancer: Intensive Care Perspectives 955**
H. Michael Ushay and Bruce M. Greenwald
 I. Introduction 955
 II. General Principles of Perioperative Care 955
 III. System-Specific Issues in the Care of the Perioperative Pediatric Oncology Patient in the PICU 959
 IV. Approach to Perioperative Cardiovascular and Organ System Support 965