

CONTENTS

PART I Common Problems

- 1 Sudden Deterioration in Neurologic Status, 1**
Alexis Steinberg and Joseph M. Darby
- 2 Agitation and Delirium, 7**
Christina Boncyk, E. Wesley Ely, and Arna Banerjee
- 3 Management of Acute Pain in the Intensive Care Unit, 13**
Lauren Coleman, Jin Lee, and Christine Cocanour
- 4 Fever and Hyperthermia, 20**
Paul Young
- 5 Very High Systemic Arterial Blood Pressure, 24**
Michael Donahoe
- 6 Low Systemic Arterial Blood Pressure, 30**
Joseph A. Hamera, Anna W. McLean, Lakhmir S. Chawla, and Kyle J. Gunnerson
- 7 Tachycardia and Bradycardia, 34**
Bryan T. Romito and Joseph S. Meltzer
- 8 Arterial Hypoxemia, 37**
Jean-Louis Vincent
- 9 Acute Respiratory Failure, 40**
Igor Barjaktarevic, Roxana Cortes-Lopez, and Tisha Wang
- 10 Hyperbaric Oxygen in Critical Care, 47**
Kinjal N. Sethuraman and Stephen R. Thom
- 11 Pulmonary Edema, 51**
Sonal R. Pannu, John W. Christman, and Elliott D. Crouser
- 12 Pleural Effusion in the Intensive Care Unit, 58**
Peter K. Moore, Hunter B. Moore, and Ernest E. Moore
- 13 Polyuria, 67**
Ramesh Venkataraman and John A. Kellum
- 14 Oliguria, 72**
Ramesh Venkataraman and John A. Kellum
- 15 Metabolic Acidosis and Alkalosis, 78**
Vinay Narasimha Krishna, Jared Cook, Keith M. Wille, and Ashita J. Tolwani
- 16 Hyperkalemia and Hypokalemia, 98**
Bryan T. Romito and Anahat Dhillon
- 17 Hyperphosphatemia and Hypophosphatemia, 102**
Marcus Ewert Broman
- 18 Hypomagnesemia, 106**
Vadim Gudzenko
- 19 Hypocalcemia and Hypercalcemia, 108**
Robert N. Cooney, Joan Dolinak, and William Marx
- 20 Disorders of Glucose Control or Blood Glucose Disorders, 112**
Roshni Sreedharan and Basem B. Abdelmalak
- 21 Anemia, 120**
Fahim Habib, Carl Schulman, and Alessia C. Cioci
- 22 Coagulopathy in the Intensive Care Unit, 128**
Hunter B. Moore, Peter K. Moore, and Ernest E. Moore
- 23 Jaundice, 134**
Ryan Rodriguez and Marie Crandall
- 24 Ascites, 139**
Zarah D. Antongiorgi and Jennifer Nguyen-Lee
- 25 Acute Abdominal Pain, 143**
Marcus K. Hoffman and S. Rob Todd
- 26 Ileus in Critical Illness, 147**
Stephen A. McClave and Endashaw Omer

- 27 Diarrhea, 151**
Christian J. Brown, Tyler J. Loftus, and Martin D. Rosenthal
- 28 Chest Pain, 155**
Daniel J. Rowan and David T. Huang
- 29 Biochemical or Electrocardiographic Evidence of Acute Myocardial Injury, 160**
Fabien Picard and Steven M. Hollenberg

PART II Common Approaches for Organ Support, Diagnosis, and Monitoring

- 30 Point-of-Care Ultrasound, 165**
Sumit P. Singh and Davinder Ramsingh
- 31 Echocardiography, 171**
Wolf Benjamin Kratzert, Pierre N. Tawfik, and Aman Mahajan
- 32 Cardiovascular Monitoring, 186**
Arthur Pavot, Xavier Monnet, and Jean-Louis Teboul
- 33 Bedside Monitoring of Pulmonary Function, 194**
John D. Davies and Amanda M. Dexter
- 34 Arterial Blood Gas Interpretation, 204**
A. Murat Kaynar
- 35 Tracheal Intubation, 214**
June M. Chae, John D. Davies, and Alexander S. Niven
- 36 Tracheostomy, 219**
Pierpaolo Terragni, Daniela Pasero, Chiara Faggiano, and V. Marco Ranieri
- 37 Basic Principles of Mechanical Ventilation, 227**
Neil R. MacIntyre
- 38 Basic Principles of Renal Replacement Therapy, 233**
Eric A.J. Hoste and Floris Vanommeslaeghe
- 39 Target Temperature Management in Critically Ill Patients, 240**
Filippo Annoni, Lorenzo Peluso, and Fabio Silvio Taccone
- 40 Extracorporeal Membrane Oxygenation (Venovenous and Venoarterial ECMO), 246**
Ali B.V. McMichael, Mehul A. Desai, Melissa E. Brunsvold, and Heidi J. Dalton
- 41 Nutritional Support, 256**
Arthur R.H. van Zanten

PART III Central Nervous System

- 42 Advanced Bedside Neuromonitoring, 265**
Jovany Cruz Navarro, Samantha Fernandez Hernandez, and Claudia S. Robertson
- 43 Coma, 270**
Melissa B. Pergakis and Wan-Tsu W. Chang
- 44 Use of Brain Injury Biomarkers in Critical Care Settings, 277**
Marie-Carmelle Elie-Turenne, Zhihui Yang, J. Adrian Tyndall, and Kevin K.W. Wang
- 45 Cardiopulmonary Cerebral Resuscitation, 282**
Joshua C. Reynolds
- 46 Management of Acute Ischemic Stroke, 300**
Ashutosh P. Jadhav and Lawrence R. Wechsler

- 47 Nontraumatic Intracerebral and Subarachnoid Hemorrhage, 312**
Subhan Mohammed and Christopher P. Robinson
- 48 Seizures in the Critically Ill, 323**
Sebastian Pollandt, Adriana C. Bermeo-Ovalle, and Thomas P. Bleck
- 49 Neuromuscular Disorders in the Critically Ill, 335**
Thomas P. Bleck
- 50 Traumatic Brain Injury, 344**
Thaddeus J. Puzio and Sasha D. Adams
- 51 Spinal Cord Injury, 351**
Christian Cain and Jose J. Diaz, Jr.
- 52 Neuroimaging, 357**
Orrin L. Dayton IV

PART IV Pulmonary

- 53 Core Principles of Respiratory Physiology and Pathophysiology in Critical Illness, 373**
John J. Marini and Luciano Gattinoni
- 54 Patient–Ventilator Interaction, 393**
Tommaso Tonetti, Raffaele Merola, Cesare Gregoretti, and V. Marco Ranieri
- 55 Noninvasive Positive-Pressure Ventilation, 401**
Anas A. Ahmed and Nicholas S. Hill
- 56 Advanced Techniques in Mechanical Ventilation, 410**
Richard D. Branson
- 57 Weaning from Mechanical Ventilation, 417**
Ferran Roche-Campo, Hernán Aguirre-Bermeo, and Jordi Mancebo
- 58 Adjunctive Respiratory Therapy, 422**
Sanjay Manocha and Keith R. Walley
- 59 Intensive Care Unit Imaging, 428**
David E. Niccum, Firas Elmufdi, and John J. Marini
- 60 Acute Respiratory Distress Syndrome, 456**
Julie A. Bastarache, Lorraine B. Ware, and Gordon R. Bernard
- 61 Drowning, 470**
Justin Sempsrott, Joost Bierens, and David Szpilman
- 62 Aspiration Pneumonitis and Pneumonia, 479**
Paul E. Marik
- 63 Severe Asthma Exacerbation in Adults, 485**
Thomas Corbridge and James Walter
- 64 Chronic Obstructive Pulmonary Disease, 493**
Peter M.A. Calverley and Paul Phillip Walker
- 65 Pulmonary Embolism, 501**
Paul S. Jansson and Christopher Kabrhel
- 66 Pneumothorax, 515**
Sharad Chandrika and David Feller-Kopman
- 67 Community-Acquired Pneumonia, 519**
Girish B. Nair and Michael S. Niederman
- 68 Nosocomial Pneumonia, 536**
Gianluigi Li Bassi, Miguel Ferrer, and Antoni Torres

PART V Cardiovascular

- 69 Core Principles of Cardiovascular Physiology and Pathophysiology in Critical Illness, 555**
Sheldon Magder
- 70 Acute Coronary Syndromes: Therapy, 565**
Brian Baturin and Steven M. Hollenberg
- 71 Supraventricular Arrhythmias, 579**
Irina Savelieva
- 72 Ventricular Arrhythmias, 588**
Raúl J. Gazmuri, Cristina Santonocito, Salvatore R. Aiello, and Donghee Kim

- 73 Conduction Disturbances and Cardiac Pacemakers, 598**
Lorenzo Pitisci, Georgiana Bentea, Ricardo E. Verdiner, and Ruben Casado-Arroyo
- 74 Myocarditis and Acute Myopathies, 605**
Fredric Ginsberg and Joseph E. Parrillo
- 75 Pericardial Diseases, 621**
Bernhard Maisch and Arsen D. Ristic
- 76 Emergency Heart Valve Disorders, 630**
Jason P. Linefsky and Catherine M. Otto
- 77 Pulmonary Hypertension and Right Ventricular Failure, 639**
Lewis J. Rubin and John Selickman
- 78 Hypertensive Crisis: Emergency and Urgency, 644**
Shweta Bansal and Stuart L. Linas
- 79 Pathophysiology and Classification of Shock States, 654**
Mark E. Astiz
- 80 Resuscitation From Circulatory Shock, 661**
Antonio Messina, Massimiliano Greco, Alessandro Protti, and Maurizio Cecconi
- 81 Inotropic Therapy, 667**
Jean-Louis Teboul, Xavier Monnet, and Mathieu Jozwiak
- 82 Mechanical Support in Cardiogenic Shock, 677**
Laura M. Seese, Arman Kilic, and Thomas G. Gleason

PART VI Gastrointestinal

- 83 Portal Hypertension: Critical Care Considerations, 691**
Paolo Angeli, Marta Tonon, Carmine Gambino, and Alessandra Brocchi
- 84 Hepatorenal Syndrome, 698**
Brent Ershoff, Colby Tanner, and Anahat Dhillon
- 85 Hepatopulmonary Syndrome, 703**
Cody D. Turner, Nasim Motayar, and David C. Kaufman
- 86 Hepatic Encephalopathy, 707**
Alvaro Martinez-Camacho, Brett E. Fortune, and Lisa Forman
- 87 Acute Liver Failure, 716**
Stephen Warrillow and Caleb Fisher
- 88 Calculous and Acalculous Cholecystitis, 727**
Samuel A. Tisherman
- 89 Acute Pancreatitis, 732**
Lillian L. Tsai and Pamela A. Lipsett
- 90 Abdominal Sepsis, 740**
Scott Brakenridge and Ashley Thompson
- 91 Mechanical Bowel Obstruction, 751**
Albert Hsu, Jens Flock IV, and Andrew J. Kerwin
- 92 Toxic Megacolon and Ogilvie's Syndrome, 754**
Chasen Ashley Croft and Maria Estela Alfaro-Maguyon
- 93 Severe Gastrointestinal Bleeding, 760**
Tyler J. Loftus and Martin D. Rosenthal

PART VII Renal

- 94 Core Principles of Renal Physiology and Pathophysiology in Critical Illness, 765**
Emily J. See, Daniel Leisman, Clifford Deutschman, and Rinaldo Bellomo
- 95 Clinical Assessment of Renal Function, 774**
Jason Kidd, Kate S. Gustafson, and Todd W.B. Gehr
- 96 Biomarkers of Acute Kidney Injury, 780**
Anja Haase-Fieltz and Michael Haase
- 97 Water Metabolism, 787**
Elchanan Fried and Charles Weissman

98 Advanced Techniques in Blood Purification, 796

Antoine Streichenberger, Pauline Sambin, Celine Monard, and Thomas Rimmelé

99 Fluid and Volume Therapy in the ICU, 802

Todd W. Robinson and Barry I. Freedman

100 Acute Kidney Injury, 809

Elwaleed A. Elhassan

101 Urinary Tract Obstruction, 819

John Montford, Scott Liebman, and Isaac Teitelbaum

102 Contrast-Induced Acute Kidney Injury, 825

Edward G. Clark, Ayub Akbari, and Swapnil Hiremath

103 Glomerulonephritis, 830

Dhruti P. Chen, Ronald J. Falk, and Gerald A. Hladik

104 Interstitial Nephritis, 836

Elizabeth S. Kotzen, Evan M. Zeitler, and Gerald A. Hladik

PART VIII Infectious Diseases

105 Antimicrobial Stewardship, 839

Marin H. Kollef and Scott T. Micek

106 Prevention and Control of Nosocomial Pneumonia, 846

Richard G. Wunderink

107 Antimicrobial Agents With Primary Activity Against Gram-Negative Bacteria, 853

Michael S. Niederman, Despoina Koulenti, and Jeffrey Lipman

108 Antimicrobial Agents With Primary Activity Against Gram-Positive Bacteria, 872

Kelli A. Cole and Diane M. Cappelletty

109 Antimicrobial Agents Active Against Anaerobic Bacteria, 880

Itzhak Brook

110 Selective Decontamination of the Digestive Tract, 886

Evelien A.N. Oostdijk, Jeroen A. Schouten, and Anne Marie G.A. de Smet

111 Intravascular Catheter-Related Infections, 892

Niccolò Buetti and Jean-François Timsit

112 Septic Shock, 902

Jean-Louis Vincent

113 Infections of the Urogenital Tract, 908

Florian M.E. Wagenlehner, Adrian Pilatz, and Kurt G. Naber

114 Central Nervous System Infections, 916

Michael J. Bradshaw and Karen C. Bloch

115 Infections of Skin, Muscle, and Necrotizing Soft Tissue Infections, 932

Rebecca Maine and Eileen M. Bulger

116 Head and Neck Infections, 939

Jeremy D. Gradon

117 Infectious Endocarditis, 944

Anastasia Antoniadou and Helen Giamarellou

118 Fungal Infections, 950

Philipp Koehler, Paul O. Gubbins, and Oliver A. Cornely

119 Influenza and Acute Viral Syndromes, 963

Sylvain A. Lother, Anand Kumar, and Steven M. Opal

120 Human Immunodeficiency Virus Infection, 977

Piotr Szychowiak, Élie Azoulay, and François Barbier

121 Infections in the Immunocompromised Patient, 989

Steven A. McGloughlin and David L. Paterson

122 Tuberculosis, 998

Melissa L. New and Edward D. Chan

123 Malaria and Other Tropical Infections in the Intensive Care Unit, 1006

Taylor Kain, Andrea K. Boggild, Frederique A. Jacquerioz, and Daniel G. Bausch

124 Clostridioides difficile Infection, 1023

Massimo Sartelli

PART IX Hematology

125 Anemia and RBC Transfusion, 1027

Erin L. Vanzant and Alicia M. Mohr

126 Guidelines for Blood Component Therapy, 1034

Alexandra L. Dixon and Martin A. Schreiber

127 Venous Thromboembolism, 1040

Simone Langness, Caitlin Collins, and M. Margaret Knudson

128 Anticoagulation in the Intensive Care Unit, 1046

Jerrold H. Levy

129 Monitoring of Coagulation Status, 1051

Ashley Thompson

130 Critical Care of the Hematopoietic Stem Cell Transplant Recipient, 1056

Robert M. Kotloff and Steve G. Peters

PART X Obstetrics

131 Cardiovascular and Endocrinologic Changes Associated With Pregnancy, 1061

Marie R. Baldisseri

132 Hypertensive Disorders in Pregnancy, 1067

Marie R. Baldisseri

133 Acute Pulmonary Complications During Pregnancy, 1074

Cornelia R. Graves

134 Postpartum Hemorrhage, 1080

Cornelia R. Graves

PART XI Endocrine

135 Diabetic Ketoacidosis and Hyperosmolar Hyperglycemic State, 1087

Jan Gunst and Greet Van den Berghe

136 Adrenal Insufficiency, 1092

Herwig Gerlach

137 Thyroid Disorders, 1102

Angela M. Leung and Alan P. Farwell

138 Diabetes Insipidus, 1111

Serge Brimioulle

PART XII Pharmacology and Toxicology

139 General Principles of Pharmacokinetics and Pharmacodynamics, 1115

Mitch A. Phelps and Henry J. Mann

140 Poisoning: Overview of Approaches for Evaluation and Treatment, 1124

Brenna Farmer

PART XIII Surgery/Trauma

141 Resuscitation of Hypovolemic Shock, 1131

S. Ariane Christie and Juan Carlos Puyana

142 Mediastinitis, 1136

Eric I. Jeng, Giovanni Piovesana, and Thomas M. Beaver

143 Epistaxis, 1140

Rohit Pravin Patel

144 Management of the Postoperative Cardiac Surgical Patient, 1144

Shailesh Rihari

- 145 Intensive Care Unit Management of Lung Transplant Patients, 1159**
Satish Chandrashekar, Amir M. Emtiazoo, and Juan C. Salgado
- 146 Perioperative Management of the Liver Transplant Patient, 1168**
Caleb Fisher and Stephen Warrillow
- 147 Intestinal and Multivisceral Transplantation: The Ultimate Treatment for Intestinal Failure, 1174**
Arpit Amin, Vikram K. Raghu, George V. Mazariegos, and Geoffrey J. Bond
- 148 Aortic Dissection, 1190**
Akiko Tanaka and Anthony L. Estrera
- 149 Mesenteric Ischemia, 1199**
Dean J. Arnaoutakis and Thomas S. Huber
- 150 Abdominal Compartment Syndrome, 1210**
Zsolt J. Balogh and Frederick A. Moore
- 151 Extremity Compartment Syndromes, 1215**
Roman Košir and Andrej Čretnik
- 152 Thromboembolization and Thrombolytic Therapy, 1227**
Anthony J. Lewis and Edith Tzeng
- 153 Atheroembolization, 1235**
Cristian Baeza and Yasir Abu-Omar
- 154 Pressure Ulcers, 1242**
Laura J. Moore
- 155 Burns, Including Inhalation Injury, 1246**
Ian R. Driscoll and Julie A. Rizzo
- 156 Thoracic Trauma, 1255**
Frank Z. Zhao and Walter L. Biff
- 157 Abdominal Trauma, 1264**
Nicole C. Toscano and Andrew B. Peitzman
- 158 Pelvic Fractures and Long Bone Fractures, 1271**
Sumeet V. Jain and Nicholas Namias
- 159 Determination of Brain Death and Management of the Brain-Dead Organ Donor, 1278**
Helen I. Opdam, Rohit L. D'Costa, Dale Gardiner, and Sam D. Shemie
- 160 Donation After Cardiac Death (Non-Heart-Beating Donation), 1288**
Stephanie Grace Yi and R. Mark Ghobrial

PART XIV Ethical and End-of-Life Issues

- 161 Conversations With Families of Critically Ill Patients, 1297**
Margaret L. Isaac and J. Randall Curtis
- 162 Resource Allocation in the Intensive Care Unit, 1303**
Gordon D. Rubenfeld
- 163 Basic Ethical Principles in Critical Care, 1309**
Nicholas S. Ward, Nicholas J. Nassikas, Thomas A. Bledsoe, and Mitchell M. Levy

PART XV Organization and Management

- 164 Building Teamwork to Improve Outcomes, 1315**
Daleen Aragon Penoyer, Carinda Feild, and Joseph Abdellatif Ibrahim
- 165 Severity of Illness Indices and Outcome Prediction, 1320**
David Harrison, Paloma Ferrando-Vivas, and James Doidge
- 166 Long-Term Outcomes of Critical Illness, 1335**
Florian B. Mayr and Sachin Yende
- 167 Early Ambulation in the ICU, 1340**
Erika L. Brinson, Angela K.M. Lipshutz, and Michael A. Gropper
- 168 Mass Critical Care, 1348**
Ariel L. Shiloh and David C. Lewandowski

- 169 Telemedicine in Intensive Care, 1362**
Alejandro J. Lopez-Magallon, Joan Sánchez-de-Toledo, and Ricardo A. Muñoz
- 170 Teaching Critical Care, 1367**
Christopher K. Schott

Online Chapters

- E1 Difficult Airway Management for Intensivists, 1370.e1**
Thomas C. Mort and F. Luke Aldo
- E2 Bedside Ultrasonography, 1370.e36**
Yanick Beaulieu and John Gorcsan III
- E3 Central Venous Catheterization, 1370.e67**
Judith L. Pepe and Jennifer L. Silvis
- E4 Arterial Cannulation and Invasive Blood Pressure Measurement, 1370.e71**
Phillip D. Levin and Yaacov Gozal
- E5 Bedside Pulmonary Artery Catheterization, 1370.e80**
Jean-Louis Vincent
- E6 Cardioversion and Defibrillation, 1370.e83**
Raúl J. Gazmuri
- E7 Transvenous and Transcutaneous Cardiac Pacing, 1370.e85**
Raúl J. Gazmuri
- E8 Ventricular Assist Device Implantation, 1370.e87**
Robert L. Kormos
- E9 Pericardiocentesis, 1370.e90**
Stefano Maggolini and Felice Achilli
- E10 Paracentesis and Diagnostic Peritoneal Lavage, 1370.e95**
Louis H. Alarcon
- E11 Thoracentesis, 1370.e99**
J. Terrill Huggins, Amit Chopra, and Peter Doelken
- E12 Chest Tube Placement, Care, and Removal, 1370.e101**
Gregory A. Watson and Brian G. Harbrecht
- E13 Fiber-Optic Bronchoscopy, 1370.e105**
Massimo Antonelli, Giuseppe Bello, and Francesca Di Muzio
- E14 Bronchoalveolar Lavage and Protected Specimen Bronchial Brushing, 1370.e111**
Lillian L. Emler
- E15 Percutaneous Dilatational Tracheostomy, 1370.e114**
Cherisse Berry and Daniel R. Margulies
- E16 Esophageal Balloon Tamponade, 1370.e118**
Jin H. Ra and Marie L. Crandall
- E17 Nasoenteric Feeding Tube Insertion, 1370.e120**
Ibrahim I. Jabbour, Albert T. Hsu, and Marie L. Crandall
- E18 Lumbar Puncture, 1370.e122**
Sarice L. Bassin and Thomas P. Bleck
- E19 Jugular Venous and Brain Tissue Oxygen Tension Monitoring, 1370.e124**
Jovany Cruz Navarro, Sandeep Markan, and Claudia S. Robertson
- E20 Intracranial Pressure Monitoring, 1370.e130**
Mauro Oddo and Fabio Taccone
- E21 Indirect Calorimetry, 1370.e133**
Pierre Singer and Guy Fishman
- E22 Extracorporeal Membrane Oxygenation Cannulation, 1370.e134**
Penny Lynn Sappington

Index, 1371