GREGORY'S

PEDIATRIC ANESTHESIA

SIXTH EDITION



EDITED BY

Dean B. Andropoulos and George A. Gregory



Gregory's Pediatric Anesthesia

Gregory's Pediatric Anesthesia

EDITED BY

Dean B. Andropoulos MD, MHCM

Anesthesiologist-in-Chief Texas Children's Hospital Professor of Anesthesiology and Pediatrics Baylor College of Medicine Houston, TX, USA

George A. Gregory MD

Professor Emeritus
Department of Anesthesia and Perioperative Care and Department of Pediatrics
University of California San Francisco (UCSF)
San Francisco, CA, USA

SIXTH EDITION

This edition first published 2020 © 2020 John Wiley & Sons Ltd

Edition History

(5e, 2012) Blackwell Publishing Ltd; (4e, 2002, 3e, 1994, 2e, 1989, 1e, 1983) Churchill Livingstone

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, except as permitted by law. Advice on how to obtain permission to reuse material from this title is available at http://www.wiley.com/go/permissions.

The right of Dean B. Andropoulos and George A. Gregory to be identified as the authors of the editorial material in this work has been asserted in accordance with law.

Registered Offices

John Wiley & Sons, Inc., 111 River Street, Hoboken, NJ 07030, USA John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, UK

Editorial Office

9600 Garsington Road, Oxford, OX4 2DQ, UK

For details of our global editorial offices, customer services, and more information about Wiley products visit us at www.wiley.com.

Wiley also publishes its books in a variety of electronic formats and by print-on-demand. Some content that appears in standard print versions of this book may not be available in other formats.

Limit of Liability/Disclaimer of Warranty

The contents of this work are intended to further general scientific research, understanding, and discussion only and are not intended and should not be relied upon as recommending or promoting scientific method, diagnosis, or treatment by physicians for any particular patient. In view of ongoing research, equipment modifications, changes in governmental regulations, and the constant flow of information relating to the use of medicines, equipment, and devices, the reader is urged to review and evaluate the information provided in the package insert or instructions for each medicine, equipment, or device for, among other things, any changes in the instructions or indication of usage and for added warnings and precautions. While the publisher and authors have used their best efforts in preparing this work, they make no representations or warranties with respect to the accuracy or completeness of the contents of this work and specifically disclaim all warranties, including without limitation any implied warranties of merchantability or fitness for a particular purpose. No warranty may be created or extended by sales representatives, written sales materials or promotional statements for this work. The fact that an organization, website, or product is referred to in this work as a citation and/or potential source of further information does not mean that the publisher and authors endorse the information or services the organization, website, or product may provide or recommendations it may make. This work is sold with the understanding that the publisher is not engaged in rendering professional services. The advice and strategies contained herein may not be suitable for your situation. You should consult with a specialist where appropriate. Further, readers should be aware that websites listed in this work may have changed or disappeared between when this work was written and when it is read. Neither the publisher nor authors shall be liable for any loss of profit or any other commercial damages, including but not limited to special, incidental, consequential, or other damages.

Library of Congress Cataloging-in-Publication Data

Names: Andropoulos, Dean B., editor. | Gregory, George A., 1934 - editor.

Title: Gregory's pediatric anesthesia / edited by Dean B. Andropoulos,
George A. Gregory.

Other titles: Pediatric anesthesia

Description: Sixth edition. | Hoboken, NJ: Wiley-Blackwell, 2020. |
Includes bibliographical references and index.

Identifiers: LCCN 2019025692 (print) | LCCN 2019035827 (ebook) | ISBN 9781119371502 (cloth) | ISBN 9781119371526 (adobe pdf) | ISBN 9781119371519 (epub)

Subjects: MESH: Anesthesia | Pediatrics-methods | Infant | Child

Classification: LCC RD139 (print) | LCC RD139 (ebook) | NLM WO 440 | DDC 617.9/6083-dc23

LC record available at https://lccn.loc.gov/2019025692 LC ebook record available at https://lccn.loc.gov/2019025693

Cover images: Baby in the lap of a nurse © Kim P. Nguyen, Meghan E. Duggan, Julie E. Nicholson; Pediatric anesthesia procedure © Thomas Shaw; Pediatric surgery with ultrasound procedure © Thomas Shaw Cover design by Wiley

Set in 9/11.5pt Palatino by SPi Global, Pondicherry, India

Contents

List of Contributors, vii

Preface, xii

List of Abbreviations, xiii

Part 1 Principles of Pediatric Anesthesia

- 1 Ethics and Professionalism in Pediatric Anesthesia, 1 David B. Waisel
- 2 History of Pediatric Anesthesia, 17 *T.C.K. Brown*
- 3 Education in Pediatric Anesthesiology: Practice in the Present with the Future in Mind, 45 Stephanie A. Black, Justin L. Lockman, and Alan Jay Schwartz
- 4 An Introduction to the Ethical Design, Conduct, and Analysis of Pediatric Clinical Trials, 56 Myron Yaster, Jeffrey Galinkin, and Mark S. Schreiner
- 5 Development of the Cardiovascular System, 76 Barry D. Kussman and Wanda C. Miller-Hance
- 6 Developmental Physiology of the Cardiovascular System, 100 Dean B. Andropoulos
- 7 Developmental Physiology of the Respiratory System, 120 Roland Neumann, Maria Victoria Fraga, Susan H. Guttentag, Dean B. Andropoulos, and Britta S. von Ungern-Sternberg
- 8 Developmental Physiology of the Central Nervous System, 143 Zoel Quinonez, R. Blaine Easley, Bruno Bissonnette, and Ken M. Brady
- 9 Developmental Physiology of the Liver, Gastrointestinal Tract, and Renal System, 164 Peter N. Bromley, Ellen Rawlinson, Zoe Harclerode, and James Bennett
- 10 Pharmacology, 191 Jean X. Mazoit

- 11 Fluids, Electrolytes, and Nutrition, 226 *Peggy McNaull and Adam Suchar*
- 12 Coagulation, Bleeding, and Blood Transfusion, 247 *Laura A. Downey, Margo R. Rollins, and Bruce E. Miller*
- 13 Cardiopulmonary Resuscitation, 276 Todd J. Kilbaugh, Robert M. Sutton, Ryan Morgan, Alexis A. Topjian, Vinay M. Nadkarni, and Robert A. Berg

Part 2 Pediatric Anesthesia Management

- 14 Anxiety, Psychological Preparation, Awareness, and Behavior Change, 298 Michelle Wright and Mike Sury
- 15 Principles of the Pediatric Perioperative Surgical Home, 312 *Lynne Ferrari*
- 16 Pediatric Airway Management, 323 John E. Fiadjoe, Paul A. Stricker, and Ronald S. Litman
- 17 Induction of, Maintenance of, and Emergence from Anesthesia, 356 *Remek Kocz, James Armstrong, and Jerrold Lerman*
- 18 Postanesthesia Care Unit Management, 386 Warwick Ames and Allison Kinder Ross
- 19 Monitoring and Vascular Access, 406 Dean B. Andropoulos
- 20 Pediatric Regional Anesthesia, 444 Claude Ecoffey

Part 3 Practice of Pediatric Anesthesia

- 21 Anesthesia for Fetal Intervention and Surgery, 475 Olutoyin A. Olutoye, Mark Rosen, and Mark D. Rollins
- 22 Anesthesia for Premature Infants, 505 *George A. Gregory*
- 23 Anesthesia for the Full-term and Ex-premature Infant, 524 Neil S. Morton, Ross Fairgrieve, Anthony Moores, and Ewan Wallace

- 24 Anesthesia for the Adolescent and Young Adult Patient, 548 Rahul G. Baijal and Dean B. Andropoulos
- 25 Anesthesia for Neurosurgical Procedures, 571 Nicholas Carling, Ken M. Brady, Bruno Bissonnette, and R. Blaine Easley
- 26 Anesthesia for Thoracic Surgery, 607
 Faith Ross, Grant McFadyen, Stefan Budac, Lynn D. Martin,
 and Michael Richards
- 27 Anesthesia for Congenital Heart Disease, 626
 David Whiting, James A. DiNardo, and Kirsten C. Odegard
- 28 Anesthesia for Non-cardiac Surgery in Patients with Congenital Heart Disease, 689 Erin A. Gottlieb
- 29 Anesthesia for Spinal Surgery in Children, 714 Joseph D. Tobias
- 30 Anesthesia for Transplantation, 740
 Manchula Navaratnam, Stephen A. Stayer, Glynn Williams,
 and Dean B. Andropoulos
- 31 Anesthesia for Abdominal Surgery, 793 Lena S. Sun, Neeta R. Saraiya, and Philipp J. Houck
- 32 Anesthesia for Pediatric Urological Procedures, 813
 Laura N. Zeigler, Katharina B. Modes, and
 Jayant K. Deshpande
- 33 Anesthesia for Orthopedic Surgery, 834
 Cathy R. Lammers, Cecile Wyckaert, and Julianna
 Clark-Wronski
- 34 Otolaryngological and Dental Surgery, 857 Olutoyin A. Olutoye, Arvind Chandrakantan, and Mehernoor Watcha
- 35 Anesthesia for Ophthalmological Surgery, 881 *Julia Chen and Olutoyin A. Olutoye*
- 36 Anesthesia for Plastic and Craniofacial Surgery, 893 Ehrenfried Schindler, Markus Martini, and Martina Messing-Jünger
- 37 Pain Management in Children, 929 Christine Greco and Charles Berde
- 38 Outpatient Anesthesia, 955 Joseph A. Scattoloni, Olubukola O. Nafiu, Shobha Malviya, and Dean B. Andropoulos
- 39 Anesthesia for Trauma, 979 Monica S. Vavilala and Sarah A. Lee
- 40 Anesthesia for Burns, 996 Gennadiy Fuzaylov

- 41 Anesthesia and Sedation Outside the Operating Room, 1012 Mohamed Mahmoud, Robert S. Holzman, and Keira P. Mason
- 42 Pediatric Intensive Care, 1041
 Rajeev Wadia, Becky J. Riggs, Dheeraj Goswami,
 Jamie McElrath Schwartz, and Melania M. Bembea
- 43 Anesthesia for the Patient with a Genetic Syndrome, 1085 David Mann, Priscilla J. Garcia, and Dean B. Andropoulos
- 44 Pediatric Anesthesia in Developing Countries, 1106 *Adrian T. Bosenberg*

Part 4 Quality, Outcomes, and Complications in Pediatric Anesthesia

- 45 Clinical Complications in Pediatric Anesthesia, 1118 Randall Flick, Christina M. Pabelick, Tracy E. Harrison, Kara A. Bjur, and Elena Ashikhmina
- 46 Impact of Pediatric Surgery and Anesthesia on Brain
 Development, 1151
 Andreas W. Loepke and Sulpicio G. Soriano
- 47 Patient Simulation and its Use in Pediatric Anesthesia, 1182

 Anita Honkanen, Michael I. Chen, and David A. Young
- 48 Databases, Registries, and Outcome Research in Pediatric Anesthesia, 1208 Joseph Cravero
- 49 Electronic Anesthesia Records: Anesthesia Information Management Systems, 1227 Allan F. Simpao and Mohamed A. Rehman
- 50 Operating Room Safety, Communication, and Teamwork, 1243 Thomas L. Shaw, Lauren M. Y. Lobaugh, and Stephen A. Stayer

Appendices

Appendix A: Pediatric Anesthesia Drugs and Other Treatments in the Perioperative Period, 1258 Dean B. Andropoulos

Appendix B: Pediatric Normal Laboratory Values, 1263 Dean B. Andropoulos

Index, 1281

List of Contributors

Warwick Ames MBBS, FRCA

Assistant Professor of Anesthesiology and Pediatrics, Duke University Medical Center, Durham, NC, USA

Dean B. Andropoulos MD, MHCM

Anesthesiologist-in-Chief, Texas Children's Hospital; Professor of Anesthesiology and Pediatrics, Department of Anesthesiology, Baylor College of Medicine, Houston, TX, USA

James Armstrong MD, FRCPC

Assistant Professor of Anesthesia, Jacobs School of Medicine and Biomedical Sciences, John R. Oishei Children's Hospital, Buffalo, NY, USA

Elena Ashikhmina MD, PhD

Senior Associate Consultant, Department of Anesthesiology; Assistant Professor of Anesthesiology, Mayo Clinic, Rochester, MN, USA

Rahul G. Baijal MD

Associate Professor of Anesthesiology and Pediatrics, Baylor College of Medicine; Texas Children's Hospital, Houston, TX, USA

Melania M. Bembea MD, MPH, PhD

Associate Professor of Anesthesiology and Critical Care Medicine, Department of Anesthesiology and Critical Care Medicine, Johns Hopkins University School of Medicine, Baltimore, MD, USA

James Bennett MBBS, FRCA

Consultant Paediatric Anaesthetist, Birmingham Children's Hospital, Birmingham, UK

Charles Berde MD, PhD

Sara Page Mayo Chair in Pediatric Pain Medicine; Chief, Division of Pain Medicine, Department of Anesthesiology, Perioperative, and Pain Medicine, Children's Hospital; Professor of Anesthesia (Pediatrics), Harvard Medical School, Boston, MA, USA

Robert A. Berg MD

Russell Raphaely Endowed Chair, Division Chief, Critical Care Medicine, The Children's Hospital of Philadelphia; Professor of Anesthesiology and Critical Care Medicine, The University of Pennsylvania School of Medicine, Philadelphia, PA, USA

Bruno Bissonnette MD

Professor, Department of Anesthesia and Critical Care Medicine, University of Toronto, Toronto, Canada

Kara A. Bjur MD

Senior Associate Consultant, Department of Anesthesiology; Instructor of Anesthesiology, College of Medicine, Mayo Clinic, Rochester, MN, USA

Stephanie A. Black MD, EdM

Assistant Professor, Perelman School of Medicine, University of Pennsylvania; Associate Director, Pediatric Anesthesiology Fellowship Program; Lead, Professional Development Programs, Department of Anesthesiology and Critical Care Medicine, The Children's Hospital of Philadelphia, Philadelphia, PA, USA

Adrian T. Bosenberg MBChB, FFA(SA)

Professor, Department of Anesthesiology, University Washington and Seattle Children's Hospital, Seattle, WA, USA

Ken M. Brady MD

Professor, Departments of Anesthesiology and Pediatrics, Northwestern University Feinberg School of Medicine, Chicago, IL, USA

Peter N. Bromley MBBS, FRCA

Consultant Paediatric Anaesthetist, Birmingham Children's Hospital, Birmingham, UK

T.C.K. Brown AM, MB ChB, MD, FANZCA, FRCA (deceased)

(Formerly) Head of Anaesthesia, Royal Children's Hospital, Melbourne, Australia

Stefan Budac MD

Attending Anesthesiologist, Department of Anesthesiology and Pain Medicine, Seattle Children's Hospital; Washington School of Medicine, Seattle, WA, USA

Nicholas Carling, MD

Associate Professor, Department of Anesthesiology, Baylor College of Medicine; Texas Children's Hospital, Houston, TX, USA

Arvind Chandrakantan MD

Associate Professor, Department of Pediatric Anesthesiology, Perioperative, and Pain Medicine, Texas Children's Hospital; Department of Anesthesiology, Baylor College of Medicine, Houston, TX, USA

Julia Chen MD

Assistant Professor, Department of Anesthesiology, Baylor College of Medicine, Houston, TX, USA

Julianna Clark-Wronski MD

Pediatric Anesthesiology, UC Davis Children's Hospital, University of California, Davis, CA, USA

Joseph Cravero MD

Senior Associate in Perioperative Anesthesia and Pain Medicine, and Associate Professor of Anaesthesia, Harvard Medical School, Boston, MA, USA

Jayant K. Deshpande MD, MPH

University of Arkansas for Medical Sciences, Arkansas Children's Hospital, Little Rock, AR, USA

James A. DiNardo MD

Cardiac Anesthesia Service, Boston Children's Hospital; Professor, Department of Anesthesia, Harvard Medical School, Boston, MA, USA

Laura A. Downey MD

Assistant Professor of Anesthesiology and Pediatrics, Emory University School of Medicine; Children's Healthcare of Atlanta at Egleston, Atlanta, GA, USA

R. Blaine Easley MD

Professor, Departments of Pediatrics and Anesthesiology, Baylor College of Medicine, Houston, TX, USA

Claude Ecoffey MD

Chairman, Pôle Anesthésie-Samu-Urgences-Réanimations et Médecine Interne-Gériatrie, Hôpital Pontchaillou, Université de Rennes 1, Rennes, France

Ross Fairgrieve MBChB, FRCA

Consultant in Paediatric Anaesthesia and Pain Management, Department of Anaesthesia, Royal Hospital for Children, Glasgow, UK

Lynne Ferrari MD

Associate Chair for Perioperative Anesthesia, Department of Anesthesiology, Critical Care and Pain Medicine, Boston Children's Hospital; Associate Professor of Anaesthesia, Harvard Medical School, Boston, MA, USA

John E. Fiadjoe MD

Associate Professor of Anesthesiology, University of Pennsylvania School of Medicine; Attending Anesthesiologist, Department of Anesthesiology and Critical Care, The Children's Hospital of Philadelphia, PA, USA

Randall Flick MD, MPH

Consultant, Departments of Anesthesiology and Pediatrics; Professor of Anesthesiology and Pediatrics, College of Medicine, Mayo Clinic; Director, Mayo Clinic Children's Center, Rochester, MN, USA

Maria Victoria Fraga MD

Neonatology Fellow, Department of Anesthesiology and Critical Care Medicine, The University of Pennsylvania School of Medicine; The Children's Hospital of Philadelphia, Philadelphia, PA, USA

Gennadiy Fuzaylov MD

Assistant Anesthetist, Department of Anesthesia, Critical Care, and Pain Management, Massachusetts General Hospital; Assistant Professor of Anaesthesia, Harvard Medical School, Boston, MA, USA

Jeffrey Galinkin MD

US Anesthesia Partners, Greenwood Village, CO, USA

Priscilla J. Garcia MD

Staff Pediatric Anesthesiologist, Texas Children's Hospital; Associate Professor, Anesthesiology and Pediatrics, Department of Anesthesiology, Baylor College of Medicine, Houston, TX, USA

Dheeraj Goswami MD

Director of Cardiac Anesthesia, Assistant Professor of Anesthesiology and Critical Care Medicine, Johns Hopkins University School of Medicine, Baltimore, MD, USA

Erin A. Gottlieb MD

Chief, Pediatric Cardiac Anesthesiology, Texas Center for Pediatric and Congenital Heart Disease, Dell Children's Hospital; Associate Professor, Department of Surgery and Perioperative Care, Dell Medical School, The University of Texas at Austin, Austin, TX, USA

Christine Greco MD

Director, Acute Pain Services, Department of Anesthesiology, Perioperative, and Pain Medicine, Children's Hospital; and Assistant Professor (Anaesthesia), Harvard Medical School, Boston, MA, USA

George A. Gregory MD

Department of Anesthesia and Perioperative Care, University of California San Francisco, San Francisco, CA, USA

Susan H. Guttentag MD

Associate Professor of Pediatrics, Director, Neonatal-Perinatal Fellowship Program, Department of Anesthesiology and Critical Care Medicine, The University of Pennsylvania School of Medicine; The Children's Hospital of Philadelphia, Philadelphia, PA, USA

Zoe Harclerode FRCA

Consultant Paediatric Anaesthetist, Sheffield Children's Hospital, Sheffield, UK

Tracy E. Harrison MD

Consultant, Department of Anesthesiology; Assistant Processor of Anesthesiology, College of Medicine, Mayo Clinic, Rochester, MN, USA

Robert S. Holzman MD, MA (Hon), FAAP

Senior Associate in Anesthesia, Boston Children's Hospital; Professor of Anesthesia, Harvard Medical School, Boston, MA, USA

Philipp J. Houck MD

Department of Anesthesiology, Columbia University College of Physicians and Surgeons, New York, NY, USA

Todd J. Kilbaugh MD

Associate Professor of Anesthesiology and Critical Care Medicine, The Children's Hospital of Philadelphia; The University of Pennsylvania School of Medicine, Philadelphia, PA, USA

Remek Kocz MD, MS

Clinical Assistant Professor of Anesthesiology, Jacobs School of Medicine and Biomedical Sciences, John R. Oishei Children's Hospital, Buffalo, NY, USA

Barry D. Kussman MBBCh, FFA(SA), FAAP

Associate Professor of Anaesthesia, Department of Anaesthesia, Harvard Medical School; Senior Associate in Cardiac Anesthesia, Department of Anesthesiology, Critical Care and Pain Medicine, Boston Children's Hospital, Boston, MA, USA

Cathy R. Lammers MD

Pediatric Anesthesiology, UC Davis Children's Hospital, University of California, Davis, CA, USA

Sarah A. Lee MD

Assistant Professor and Director of Trauma Anesthesiology Fellowship, Department of Anesthesiology and Pain Medicine, University of Washington School of Medicine, Seattle, WA, USA

Jerrold Lerman MD, FRCPC, FANZCA

Clinical Professor of Anesthesia, Jacobs School of Medicine and Biomedical Sciences, John R. Oishei Children's Hospital, Buffalo, NY, USA

Ronald S. Litman DO

Professor of Anesthesiology and Pediatrics, University of Pennsylvania School of Medicine; Attending Anesthesiologist, Department of Anesthesiology and Critical Care, The Children's Hospital of Philadelphia, PA, USA

Lauren M. Y. Lobaugh MD

Staff Anesthesiologist, Texas Children's Hospital; Assistant Professor, Department of Anesthesiology, Perioperative, and Pain Medicine, Baylor College of Medicine, Houston, TX, USA

Justin L. Lockman MD, MSEd

Assistant Professor, Perelman School of Medicine, University of Pennsylvania; Director, Pediatric Anesthesiology Fellowship Program; Associate Director of Education, Department of Anesthesiology and Critical Care Medicine, The Children's Hospital of Philadelphia, Philadelphia, PA, USA

Andreas W. Loepke MD, PhD, FAAP

Endowed Chair in Pediatric Cardiac Anesthesiology, Professor of Anesthesiology and Critical Care, and Professor of Pediatrics, Perelman School of Medicine, University of Pennsylvania; Chief, Cardiac Anesthesiology, Department of Anesthesiology and Critical Care Medicine, The Children's Hospital of Philadelphia, Philadelphia, PA, USA

Mohamed Mahmoud MD

Professor of Clinical Anesthesia, Department of Anesthesiology, Cincinnati Children's Hospital Medical Center, University of Cincinnati, Cincinnati, OH, USA

Shobha Malviya, MD

Associate Director, Pediatric Anesthesiology; Professor of Anesthesiology, Department of Anesthesiology, University of Michigan, Ann Arbor, MI, USA

David Mann MD

Staff Pediatric and Obstetric Anesthesiologist, Texas Children's Hospital; Associate Professor, Anesthesiology and Pediatrics, Department of Anesthesiology, Baylor College of Medicine, Houston, TX, USA

Lynn D. Martin MD, FAAP, FCCM

Director, Department of Anesthesiology and Pain Medicine; Medical Director, Bellevue Clinics and Surgery Center, Seattle Children's Hospital; Professor of Anesthesiology and Pediatrics (Adjunct), University of Washington School of Medicine, Seattle, WA, USA

Markus Martini PD, Dr. med.

Department of Maxillo-Facial Surgery, St. Lukas Hospital, Solingen, Germany

Keira P. Mason MD

Senior Associate in Anesthesia, Department of Anesthesiology, Critical Care, and Pain Medicine, Boston Children's Hospital; Associate Professor of Anesthesia (Radiology), Harvard Medical School, Boston, MA, USA

Jean X. Mazoit MD, PhD

Staff Anesthetist, Département d'Anesthésie-Réanimation, Hôpitaux Universitaires Paris-Sud AP-HP, Paris, France

Jamie McElrath Schwartz MD

Medical Director, Pediatric Intensive Care Unit; Assistant Professor of Anesthesiology and Critical Care Medicine, Johns Hopkins University School of Medicine, Baltimore, MD, USA

Grant McFadyen MBChB, DA(SA), FRCA

Attending Anesthesiologist, Lucille Packard Children's Hospital; Assistant Professor, Stanford University School of Medicine, Stanford, CA, USA

Peggy McNaull MD

Professor of Anesthesiology and Pediatrics, Associate Chief Medical Officer, Quality and Safety, Vice Chair for Patient Safety and Quality Improvement, Department of Anesthesiology, University of North Carolina, Chapel Hill, NC, USA

Martina Messing-Jünger Prof., Dr. med.

Department of Neurosurgery, Asklepios Klinik Sankt Augustin, Sankt Augustin, Germany

Bruce E. Miller MD

Chief, Division of Pediatric Anesthesiology and Associate Professor of Anesthesiology and Pediatrics, Emory University School of Medicine; Director, Pediatric Cardiac Anesthesiology, Children's Healthcare of Atlanta at Egleston, Atlanta, GA, USA

Wanda C. Miller-Hance MD, FACC, FAAP, FASE

Associate Director, Arthur S. Keats Division of Pediatric Cardiovascular Anesthesiology, Texas Children's Hospital; Department of Anesthesiology, Perioperative and Pain Medicine, and Department of Pediatrics, Baylor College of Medicine, Houston, TX, USA

Katharina B. Modes MD

Department of Anesthesiology, Monroe Carell Jr Children's Hospital at Vanderbilt, Vanderbilt University Medical Center, Nashville, TN, USA

Anthony Moores MBChB, FRCA

Consultant in Paediatric Anaesthesia and Pain Management, Department of Anaesthesia, Royal Hospital for Children, Glasgow, UK

Ryan Morgan MD

Assistant Professor of Anesthesiology and Critical Care Medicine, The Children's Hospital of Philadelphia; The University of Pennsylvania School of Medicine, Philadelphia, PA, USA

Neil S. Morton MD, FRCA

Retired Reader in Paediatric Anaesthesia and Pain Management, Department of Anaesthesia, Royal Hospital for Children, Glasgow, UK

Vinay M. Nadkarni MD MS

Endowed Chair, Pediatric Critical Care Medicine, The Children's Hospital of Philadelphia; The University of Pennsylvania School of Medicine, Philadelphia, PA, USA

Olubukola O. Nafiu MD

Director, Pediatric Anesthesia Research, and Associate Professor of Anesthesiology, Department of Anesthesiology, University of Michigan, Ann Arbor, MI, USA

Manchula Navaratnam MD

Pediatric Cardiac Anesthesiologist, Lucille Packard Children's Hospital at Stanford; Clinical Assistant Professor of Anesthesia, Department of Anesthesia, Stanford University School of Medicine, Palo Alto, CA, USA

Roland Neumann MD

Consultant in Neonatal Intensive Care, Department of Neonatology, University of Basel Children's Hospital, Basel, Switzerland

Kirsten C. Odegard MD

Cardiac Anesthesia Service, Boston Children's Hospital; Associate Professor, Department of Anesthesia, Harvard Medical School, Boston, MA, USA

Olutoyin A. Olutoye MD, MSc

Professor, Department of Pediatric Anesthesiology, Perioperative, and Pain Medicine, Texas Children's Hospital; Department of Anesthesiology, Baylor College of Medicine, Houston, TX, USA

Christina M. Pabelick MD

Consultant, Department of Anesthesiology; Professor of Anesthesiology and Physiology, College of Medicine, Mayo Clinic, Rochester, MN, USA

Zoel Ouinonez MD

Clinical Assistant Professor, Departments of Anesthesiology, Perioperative and Pain Medicine, Stanford University School of Medicine, Stanford, CA, USA

Ellen Rawlinson MA, MBBChir, MRCP, FRCA

Consultant Paediatic Anaesthetist, Great Ormond Street Hospital, London, UK

Mohamed A. Rehman MD

Professor of Anesthesiology, Critical Care, and Pediatrics; Chair, Department of Anesthesiology, Johns Hopkins All Children's Hospital, St Petersburg, FL, USA

Michael Richards BM, MRCP, FRCA

Attending Anesthesiologist, Department of Anesthesiology and Pain Medicine, Seattle Children's Hospital; Assistant Professor, University of Washington School of Medicine, Seattle, WA, USA

Becky J. Riggs MD

Assistant Professor of Anesthesiology and Critical Care Medicine, Johns Hopkins University School of Medicine, Baltimore, MD, USA

Margo R. Rollins MD

Assistant Professor of Pathology, Department of Pathology, Emory University School of Medicine; Assistant Medical Director of Tissue, Transfusion, and Apheresis, Center for Transfusion and Cellular Therapy, Children's Healthcare of Atlanta at Egleston, Atlanta, GA, USA

Mark D. Rollins MD, PhD

Professor and Director Obstetric Anesthesia, Department of Anesthesiology, University of Utah, Salt Lake City, UT, USA

Mark Rosen MD

Professor Emeritus, University of California San Francisco, Department of Anesthesia and Perioperative Care, San Francisco, CA, USA

Allison Kinder Ross MD

Associate Professor of Anesthesiology and Pediatrics, Duke University Medical Center, Durham, NC, USA

Faith Ross, MD, MS

Attending Anesthesiologist, Department of Anesthesiology and Pain Medicine, Seattle Children's Hospital; Washington School of Medicine, Seattle, WA, USA

Neeta R. Saraiya MD

Department of Anesthesiology, Columbia University College of Physicians and Surgeons, New York, NY, USA

Joseph A. Scattoloni MD

Assistant Professor of Anesthesiology, Department of Anesthesiology, University of Michigan, Ann Arbor, MI, USA

Ehrenfried Schindler Dr. med.

Department of Anesthesiology and Critical Care Medicine, Section "Pediatric Anesthesiology", University Hospital Bonn, Bonn, Germany

Mark S. Schreiner MD

Emeritus Associate Professor of Anesthesia and Critical Care, Perelman School of Medicine, University of Pennsylvania; The Children's Hospital of Philadelphia, Philadelphia, PA, USA

Alan Jay Schwartz MD, MSEd

Director of Education, Department of Anesthesiology and Critical Care Medicine, The Children's Hospital of Philadelphia; Professor of Clinical Anesthesiology and Critical Care, Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA, USA

Thomas L. Shaw MD

Staff Anesthesiologist, Texas Children's Hospital; Associate Professor, Department of Anesthesiology, Perioperative, and Pain Medicine, Baylor College of Medicine, Houston, TX, USA

Allan F. Simpao MD, MBI

Assistant Professor of Anesthesiology and Critical Care, Department of Anesthesiology and Critical Care, Children's Hospital of Philadelphia; Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA, USA

Sulpicio G. Soriano MD

Professor of Anaesthesia, Harvard Medical School; Endowed Chair in Pediatric Neuroanesthesia, Department of Anesthesiology, Critical Care, and Pain Medicine, Boston Children's Hospital, Boston, MA, USA

Stephen A. Stayer MD

Staff Anesthesiologist, Texas Children's Hospital; Professor, Department of Anesthesiology, Perioperative, and Pain Medicine, Baylor College of Medicine, Houston, TX, USA

Paul A. Stricker MD

Associate Professor of Anesthesiology, University of Pennsylvania School of Medicine; Attending Anesthesiologist, Department of Anesthesiology and Critical Care, The Children's Hospital of Philadelphia, Philadelphia, PA, USA

Adam Suchar MD

Assistant Professor of Anesthesiology and Pediatrics, Department of Anesthesiology, University of North Carolina, Chapel Hill, NC, USA

Lena S. Sun MD

Department of Anesthesiology and Pediatrics, Columbia University College of Physicians and Surgeons, New York, NY, USA

Mike Sury MB BS, FRCA, PhD

Consultant Anaesthetist, Department of Anaesthesia, Great Ormond Street Hospital for Sick Children, London, UK

Robert M. Sutton MD MSCE

Associate Professor of Anesthesiology and Critical Care Medicine, The Children's Hospital of Philadelphia; The University of Pennsylvania School of Medicine, Philadelphia, PA, USA

Joseph D. Tobias MD

Chairman, Department of Anesthesiology and Pain Medicine, Nationwide Children's Hospital; Professor of Anesthesiology and Pediatrics, The Ohio State University, Columbus, OH, USA

Alexis A. Topjian MD

Associate Professor of Anesthesiology and Critical Care Medicine, The Children's Hospital of Philadelphia; The University of Pennsylvania School of Medicine, Philadelphia, PA, USA

Britta S. von Ungern-Sternberg MD, PhD

Chair of Paediatric Anaesthesia, Department of Anaesthesia and Pain Management, Perth Children's Hospital, The University of Western Australia; Telethon Kids Institute, Perth, Australia

Monica S. Vavilala MD

Professor and Vice Chair Clinical Research (Interim), Anesthesiology and Pediatrics, Department of Anesthesiology and Pain Medicine, University of Washington School of Medicine, Seattle, WA, USA

Rajeev Wadia MD

Assistant Professor of Anesthesiology and Critical Care Medicine, Johns Hopkins University School of Medicine, Baltimore, MD, USA

David B. Waisel MD

Associate Professor of Anaesthesia, Harvard Medical School; Senior Associate in Anaesthesia, Boston Children's Hospital, Boston, MA, USA

Ewan Wallace MBChB, FRCA

Consultant in Paediatric Anaesthesia and Pain Management, Department of Anaesthesia, Royal Hospital for Children, Glasgow, UK

Mehernoor Watcha MD

Associate Professor, Department of Pediatric Anesthesiology, Perioperative, and Pain Medicine, Texas Children's Hospital; Department of Anesthesiology, Baylor College of Medicine, Houston, TX, USA

David Whiting MD

Cardiac Anesthesia Service, Boston Children's Hospital; Assistant Professor, Department of Anesthesia, Harvard Medical School, Boston, MA, USA

Glynn Williams MD

Pediatric Cardiovascular Anesthesiologist, Lucille Packard Children's Hospital at Stanford; Professor of Anesthesia, Department of Anesthesia, Stanford University School of Medicine, Palo Alto, CA, USA

Michelle Wright BSc(Hons), MBBS, FRCA

Locum consultant paediatric anaesthetist, Great Ormond Street Hospital for Sick Children, London, UK

Cecile Wyckaert MD

Pediatric Anesthesiology, UC Davis Children's Hospital, University of California, Davis, CA, USA

Myron Yaster MD

Professor, Department of Anesthesiology and Pediatrics, Children's Hospital Colorado, University of Colorado at Denver, Aurora, CO, USA

Laura N. Zeigler MD, MPH

Department of Anesthesiology, Monroe Carell Jr Children's Hospital at Vanderbilt, Vanderbilt University Medical Center, Nashville, TN, USA