NEPHROLOGY AND FLUID/ELECTROLYTE PHYSIOLOGY

Neonatology Questions and Controversies

Series Editor

Richard A. Polin, MD
Professor of Pediatrics
College of Physicians and Surgeons
Columbia University
Vice Chairman for Clinical and Academic Affairs
Department of Pediatrics
Director, Division of Neonatology
Morgan Stanley Children's Hospital of NewYork-Presbyterian
Columbia University Medical Center
New York, New York

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NEPHROLOGY AND FLUID/ELECTROLYTE PHYSIOLOGY

Neonatology Questions and Controversies

William Oh, MD
Professor of Pediatrics
Alpert Medical School of Brown University
Attending Neonatologist
Women and Infants' Hospital
Providence, Rhode Island

Jean-Pierre Guignard, MD
Honorary Professor of Pediatrics
Lausanne University Medical School
Centre Hospitalier Universitaire Vaudois
Lausanne, Switzerland

Stephen Baumgart, MD
Professor of Pediatrics
Children's National Medical Center
Department of Pediatrics
George Washington University School of Medicine
Washington, District of Columbia

Consulting Editor
Richard A. Polin, MD
Professor of Pediatrics
College of Physicians and Surgeons
Columbia University
Vice Chairman for Clinical and Academic Affairs
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Director, Division of Neonatology
Morgan Stanley Children's Hospital of NewYork-Presbyterian
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Senior Project Manager: Anne Konopka
Design Direction: Ellen Zanolle

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Contributors

Sharon P. Andreoli, MD
Byron P. and Frances D. Hollett Professor of Pediatrics
Department of Pediatrics
James Whitcomb Riley Hospital for Children
Indiana University Medical School
Indianapolis, Indiana
Kidney Injury in the Neonate

Stephen Baumgart, MD
Professor of Pediatrics
Children's National Medical Center
Department of Pediatrics
George Washington University School of Medicine
Washington, District of Columbia
Acute Problems of Prematurity: Balancing Fluid Volume and Electrolyte Replacements in Very Low Birth Weight and Extremely Low Birth Weight Neonates

Marie H. Beall, MD
Clinical Professor of Obstetrics and Gynecology
David Geffen School of Medicine
University of California, Los Angeles
President
Los Angeles Perinatal Associates
Los Angeles, California
Water Flux and Amniotic Fluid Volume: Understanding Fetal Water Flow

Richard D. Bland, MD
Professor of Pediatrics
Stanford University School of Medicine
Stanford, California
Lung Fluid Balance in Developing Lungs and Its Role in Neonatal Transition

Farid Boubred, MD
Division of Neonatology
Hopital de la Conception
Assistance Publique-Hôpitaux de Marseille, France
Faculte de Medecine
Aix-Marseille Université
Marseille, France
The Developing Kidney and the Fetal Origins of Adult Cardiovascular Disease

Christophe Buffat, PharmD
Assistant Hospitalo-Universitaire
Laboratory of Biochemistry and Molecular Biology
Hopital de la Conception
Assistance Publique-Hôpitaux de Marseille, France
Aix-Marseille Université
Marseille, France
The Developing Kidney and the Fetal Origins of Adult Cardiovascular Disease

Robert L. Chevalier, MD
David Harrison Distinguished Professor of Pediatrics
Department of Pediatrics
The University of Virginia
Charlottesville, Virginia
Obstructive Uropathy: Assessment of Renal Function in the Fetus

Andrew T. Costarino, MD
Professor of Anesthesiology and Pediatrics
Department of Anesthesiology
Thomas Jefferson University School of Medicine
Philadelphia, Pennsylvania
Chairman
Department of Anesthesiology & Critical Care Medicine
Alfred I. duPont Hospital for Children
Wilmington, Delaware
Edema

Andrea Dotta, MD
Division of Newborn Medicine
Bambino Gesù Children's Hospital and Research Institute
Rome, Italy
Renal Modulation: Arginine Vasopressin and Atrial Natriuretic Peptide

Francesco Emma, MD
Division Head
Division of Nephrology and Dialysis
Bambino Gesù Children's Hospital and Research Institute
Rome, Italy
Renal Modulation: Arginine Vasopressin and Atrial Natriuretic Peptide

Daniel I. Feig, MD, PhD
Professor of Pediatrics
Director
Division of Pediatric Nephrology
University of Alabama, Birmingham
Birmingham, Alabama
Renal Urate Metabolism in the Fetus and Newborn

Joseph T. Flynn, MD, MS
Director
Pediatric Hypertension Program
Seattle Children's Hospital
Professor
Department of Pediatrics
University of Washington School of Medicine
Seattle, Washington
Neonatal Hypertension: Diagnosis and Management

Jean-Bernard Gouyon, MD
Neonatology
Centre Etudes Perinatales de l'Ocean Indien CHR de la Reunion
GHSR Reunion Island, France
Glomerular Filtration Rate in Neonates

Jean-Pierre Guignard, MD
Honorary Professor of Pediatrics
Lausanne University Medical School
Centre Hospitalier Universitaire Vaudois
Lausanne, Switzerland
Glomerular Filtration Rate in Neonates, Use of Diuretics in the Newborn

Lucky Jain, MD, MBA
Richard W. Blumberg Professor & Executive Vice Chairman
Department of Pediatrics
Emory University School of Medicine
Atlanta, Georgia
Lung Fluid Balance in Developing Lungs and Its Role in Neonatal Transition

Pedro A. Jose, MD, PhD
Director
Center for Molecular Physiology Research
Children's National Medical Center
Professor
Pediatrics and Medicine
George Washington University School of Medicine & Public Health
Washington, District of Columbia
Renal Modulation: The Renin-Angiotensisn-Aldosterone System

Sarah D. Keene, MD
Assistant Professor of Pediatrics
Division of Neonatal/Perinatal Medicine
Emory University
Atlanta, Georgia
Lung Fluid Balance in Developing Lungs and Its Role in Neonatal Transition

Yosef Levenbrown, DO
Fellow in Pediatric Critical Care
Thomas Jefferson University School of Medicine
Department of Anesthesiology and Critical Care Medicine
Alfred I. duPont Hospital for Children
Wilmington, Delaware
Edema

John M. Lorenz, MD
Professor of Clinical Pediatrics
Division of Neonatology
Columbia University
New York, New York
Potassium Metabolism

Ran Namgung, MD, PhD
Professor of Pediatrics
Department of Pediatrics
Yonsei University College of Medicine
Seoul, Korea
Perinatal Calcium and Phosphorus Metabolism

Aruna Natarajan, MD, DCh, PhD
Associate Professor of Pediatrics, Pharmacology and Physiology
Attending Pediatric Intensivist
Georgetown University Hospital and School of Medicine
Washington, District of Columbia
Renal Modulation: The Renin-Angiotensin-Aldosterone System

William Oh, MD
Professor of Pediatrics
Alpert Medical School of Brown University
Attending Neonatologist
Women and Infants' Hospital
Providence, Rhode Island
Body Water Changes in the Fetus and Newborn: Normal Transition After Birth and the Effects of Intrauterine Growth Aberration

Michael G. Ross, MD, MPH
Professor of Obstetrics and Gynecology and Public Health
David Geffen School of Medicine
University of California Los Angeles School of Public Health
Los Angeles, California
Water Flux and Amniotic Fluid Volume: Understanding Fetal Water Flow

Istvan Seri, MD, PhD
Professor of Pediatrics
Department of Pediatrics
Division of Neonatal Medicine
Keck School of Medicine
University of Southern California
Center for Fetal and Neonatal Medicine
Children's Hospital Los Angeles
Los Angeles, California
University of Southern California Medical Center
Los Angeles, California
Acid Base Homeostasis in the Fetus and Newborn

Umberto Simeoni, MD
Professor of Pediatrics
Division of Neonatology
Hôpital de La Conception
Assistance Publique-Hôpitaux de Marseille, France
Faculté de Médecine & INSERM UMR608
Aix-Marseille Université
Marseille, France
The Developing Kidney and the Fetal Origins of Adult Cardiovascular Disease

Endre Sulyok, MD, PhD, DSc
Professor of Pediatrics
Faculty of Health Sciences
University of Pécs
Pécs, Hungary
Renal Aspects of Sodium Metabolism in the Fetus and Neonate

Reginald C. Tsang, MBBS
Professor Emeritus of Pediatrics
Division of Neonatology
Cincinnati Children's Hospital Medical Center
Cincinnati, Ohio
Perinatal Calcium and Phosphorus Metabolism

Daniel Vaiman, PhD
Institut Cochin
INSERM 1016
Genetics and Development Department
Universite Paris Descartes
Paris, France
The Developing Kidney and the Fetal Origins of Adult Cardiovascular Disease

Jeroen P.H.M. van den Wijngaard, PhD
Biomedical Engineering and Physics
Academic Medical Center
University of Amsterdam
Department of Medical Physics
Academic Medical Center
University of Amsterdam
Amsterdam, the Netherlands
Water Flux and Amniotic Fluid Volume: Understanding Fetal Water Flow

Martin van Gemert, PhD
Professor of Clinical Applications of Laser Physics
Director
The Laser Center
Academic Medical Center
University of Amersterdam
Amsterdam, the Netherlands
Water Flux and Amniotic Fluid Volume: Understanding Fetal Water Flow

Marc Zaffanello, MD
Professor, Pediatrician
Department of Life and Reproduction Sciences
University of Verona
Verona, Italy
Renal Modulation: Arginine Vasopressin and Atrial Natriuretic Peptide

Israel Zelikovic, MD
Director
Division of Pediatric Nephrology
Rambam Medical Center
Director and Associate Professor
Laboratory of Developmental Nephrology
Department of Physiology and Biophysics
Rappaport Faculty of Medicine and Research Institute
Technion-Israel Institute of Technology
Haifa, Israel
Hereditary Tubulopathies

Series Foreword

Richard A. Polin, MD

"Medicine is a science of uncertainty and an art of probability."

—William Osler

Controversy is part of every day practice in the NICU. Good practitioners strive to incorporate the best evidence into clinical care. However, for much of what we do, the evidence is either inconclusive or does not exist. In those circumstances, we have come to rely on the teachings of experienced practitioners who have taught us the importance of clinical expertise. This series, "Neonatology Questions and Controversies," provides clinical guidance by summarizing the best evidence and tempering those recommendations with the art of experience.

To quote David Sackett, one of the founders of evidence-based medicine:

> *Good doctors use both individual clinical expertise and the best available external evidence* and neither alone is enough. *Without clinical expertise, practice risks become tyrannized by evidence, for even excellent external evidence may be inapplicable to or inappropriate for an individual patient. Without current best evidence, practice risks become rapidly out of date to the detriment of patients.*

This series focuses on the challenges faced by care providers who work in the NICU. When should we incorporate a new technology or therapy into every day practice, and will it have positive impact on morbidity or mortality? For example, is the new generation of ventilators better than older technologies such as CPAP, or do they merely offer more choices with uncertain value? Similarly, the use of probiotics to prevent necrotizing enterocolitis is supported by sound scientific principles (and some clinical studies). However, at what point should we incorporate them into every day practice given that the available preparations are not well characterized or proven safe? A more difficult and common question is when to use a new technology with uncertain value in a critically ill infant. As many clinicians have suggested, sometimes the best approach is to do nothing and "stand there."

The "Questions and Controversies" series was developed to highlight the clinical problems of most concern to practitioners. The editors of each volume (Drs. Bancalari, Oh, Guignard, Baumgart, Kleinman, Seri, Ohls, Maheshwari, Neu, and Perlman) have done an extraordinary job in selecting topics of clinical importance to every day practice. When appropriate, less controversial topics have been eliminated and replaced by others thought to be of greater clinical importance. In total, there are 56 new chapters in the series. During the preparation of the "Hemodynamics and Cardiology" volume, Dr. Charles Kleinman died. Despite an illness that would have caused many to retire, Charlie worked until near the time of his death. He came to work each day, teaching students and young practitioners and offering his wisdom and expertise to families of infants with congenital heart disease. We are dedicating the second edition of the series to his memory. As with the first edition, I am indebted to the exceptional group of editors who chose the content and edited each of the volumes. I also wish to thank Lisa Barnes (content development specialist at Elsevier) and Judy Fletcher (publishing director at Elsevier), who provided incredible assistance in bringing this project to fruition.

Foreword

Interest in the care of the premature baby developed more than 100 years ago. Nevertheless, newborn babies had to wait until the 1940s for investigators to focus on their immature kidneys. Jean Oliver, Edith Louise Potter, George Fetterman and Robert Vernier were among the first to study and describe the structures of the immature kidney. Most of the basic knowledge on the function of the neonatal kidney was also developed between the early 1940s and the early 1970s. While Homer Smith at New York University College of Medicine was in the process of establishing the basic concepts of mature renal physiology, two investigators explored the function of the immature kidney and founded the scientific basis of modern perinatal nephrology: Henry Barnett at Albert Einstein College of Medicine in New York and Reginald McCance at the University of Cambridge in the UK. Quantification of glomerular filtration rate was established, first in infants, then in term neonates and later on in tiny premature neonates. The ability of the immature kidney to modify the glomerular ultrafiltrate, to dilute or concentrate the urine, to get rid of an acid load, to produce and respond to various hormones, and to maintain constant the neonate's body fluid volume and composition, was subsequently investigated. When it became clear that dysfunction and dysgenesis of the kidney could have long lasting consequences, fetal developmental studies were conducted with the aim of understanding the pathogenesis of renal diseases and dysfunctions from the early days of gestation.

Studies on the key role played by the placenta in maintaining the homeostasis of the fetus, as well as research on the formation and function of the fetal and the postnatal kidney have grown exponentially in the last decades. A bewildering amount of results, sometimes contradictory, has been produced, clarifying many yet unsolved problems, but also raising new questions. The interpretation of published clinical or experimental data, as well as the establishment of practical guidelines most often based on poorly or ill-controlled clinical trials generated controversies that sometimes disconcerted the physician in charge of still-unborn or newly-born infants.

The purpose of this new series entitled *Neonatology Questions and Controversies* is to discuss precisely the scientific basis of perinatal medicine. It also aims to present a rational, critical analysis of current concepts in different fields related to fetuses and newborn infants. To cover the various topics presented in this *Nephrology and Fluid/Electrolyte Physiology* volume, such as placental and perinatal physiology, pathophysiology and pathology, the editors gathered a distinguished group of contributors who are all leading experts in their respective fields. It is our conviction that physicians and students will benefit from this authoritative source of critical knowledge to improve the fate of fetuses and neonates under their care.

We thank all our contributors for their dedication and generous cooperation.

Jean-Pierre Guignard, MD

Preface

A preface is to give the editors the opportunity to review the events since the publication of the previous edition; update, add, or delete the various chapters; and thank the authors for their efforts and expertise in their contribution.

Since the publication of the first edition of this monograph 3 years ago, the survival rates of newborn infants in this country and abroad has been maintained at a healthy pace. The quality of life of most survivors is good. These achievements are the results of many evidence-based management strategies developed and implemented by dedicated care providers of this population. An important component of these strategies is the fluid and electrolyte therapy and management of various renal disorders of the high-risk infants. We believe that our first edition has filled the role of providing new knowledge and treatment modalities to the care providers. The book's popularity among our readership is evident by the high volume of sales and the publication of a Spanish version for our Latin American colleagues in South America and elsewhere (*Ediciones Journal*, Buenos Aires, 2011).

In addition to updating all of the chapters in the first edition with the addition of numerous references, the editors have added six new chapters to this edition. We mourned the passing of a talented and esteemed author, Dr. Karl Bauer. One of us (Dr. Oh), who was Dr. Bauer's mentor, took the responsibility of writing a chapter that expands the contents of Dr. Bauer's original chapter to include the body fluid changes during the transitional period. We also believe that urate, calcium, and phosphorus metabolisms are important parts of fluid and electrolyte management in the perinatal period. We were very fortunate to have successfully recruited Drs. Ron Namrung and Reginald C. Tsang, two authorities in this field, to write the chapter on perinatal calcium and phosphorus metabolism and Dr. Daniel Feig, an expert in perinatal urate metabolism, to write a chapter on this important subject. In addition, we added a chapter on neonatal hypertension written by Dr. Joseph Flynn, who is well known in this field. Recognizing that there are two areas in neonatal nephrology and fluid and electrolyte therapy that deserve inclusion in this publication—hereditary tubulopathies and the use of diuretics in newborns—we have asked Dr. Israel Zelikovic and one of us (Dr. Guignard) to fill those gaps.

We would like to express our deepest gratitude to all of the authors for their hard work in updating and writing new chapters in this book. We believe that with the update and the six new chapters, this book will continue to serve our dedicated physicians, nurses, and other allied health care providers as a reference in providing fluid and electrolyte therapy and management of renal diseases in this most vulnerable population. We anticipate that optimal management of these conditions, along with other management strategies, will continue to contribute to good outcomes among high-risk infants.

William Oh, MD
Jean-Pierre Guignard, MD
Stephen Baumgart, MD