

Table of Contents

Guest Editors for this issue:

Erika Berman Rosenzweig, MD
Assistant Professor of Pediatrics
Department of Pediatrics
Columbia College of Physicians
and Surgeons
New York, New York

Kristin Highland, MD
Assistant Professor
Division of Pulmonary and
Critical Care
Director, Pulmonary Hypertension
Clinic
Medical University of South Carolina
Charleston, South Carolina

- 108 Profiles in PH:
Joseph K. Perloff, MD
- 121 Pulmonary Arterial Hypertension
in Adults with Congenital Heart
Disease: General Overview of
Disease Mechanisms
- 126 Evaluating Operability in Adults
with Congenital Heart Disease
and the Role of Pretreatment
with Targeted Pulmonary Arterial
Hypertension Therapy
- 136 Emerging Therapy of Congenital
Heart Disease Associated with
Pulmonary Hypertension
- 142 Pulmonary Hypertension
Roundtable

Publisher

Pulmonary Hypertension Association
Michael D. McGoon, MD, *Chair of the Board*
Rino Aldrighetti, *President*
Rachel Pokorney, *Associate Director of Medical Services*

Publishing Staff

Stu Chapman, *Executive Editor*
Susan Chapman, *Managing Editor*
Heidi Green, *Associate Editor*
Gloria Catalano, *Production Director*
Michael McClain, *Design Director*

PHA Office

Pulmonary Hypertension Association
801 Roeder Rd, Suite 400
Silver Spring, MD 20910-4496
301-565-3004, 301-565-3994 (fax)
www.phassociation.org

© 2007 by Pulmonary Hypertension Association. All rights reserved. None of the contents may be reproduced in any form whatsoever without the written permission of PHA.

ISSN: 1933-088X (print); 1933-0898 (online)

Editorial Offices

Advances in Pulmonary Hypertension, DataMedica,
P.O. Box 1688, Westhampton Beach, NY 11978
Tel (631) 288-7733 Fax (631) 288-7744
E-mail: sbelsonchapman@aol.com

Advances in Pulmonary Hypertension is circulated to cardiologists, pulmonologists, rheumatologists and other selected physicians by the Pulmonary Hypertension Association. The contents are independently determined by the Editor and the Editorial Advisory Board. All past issues of the *Pulmonary Hypertension* are available at: www.PHAssociation.org/Medical/Advances_in_PH/

Cover image:

Diagnostic tools used to evaluate and define shown perimembranous ventricular septal defect (center). From top left, clockwise: 2-D echocardiogram and continuous wave Doppler assessment of tricuspid regurgitant velocity, electrocardiogram, contrast ventriculography, and simultaneous RV and LV pressure tracing.

Editor's Memo

Another Milestone for PHA Mission to Promote Awareness



With this third issue of *Advances in Pulmonary Hypertension* in 2007, I must first recognize the enormous success of the Pulmonary Hypertension Resource Network Symposium held in Crystal City, Virginia this October. Attendance was a record 400+ (up from 60 in 2003), and the representation was far-reaching, with attendees and participants from Oregon to Washington, DC, and Canada to Texas. This clearly reflects the tremendous interest in this growing field and speaks to the success of PHA in its mission to promote pulmonary hypertension awareness.

Associate Editor Erika Berman Rosenzweig, MD, has taken the role of Lead Editor of this issue and with Editorial Board member Kristin Highland, MD, has put together a comprehensive review of pulmonary arterial hypertension (PAH) related to congenital heart disease (CHD), with three key pieces focused on CHD. Dr Ingram Schulze-Neick provides an overview of pulmonary vascular disease in CHD, while Dr Michael Landzberg covers emerging medical therapies, and Drs Konstantinos Dimopoulos and Michael Gatzoulis teach us about how to evaluate operability in adults with CHD, as well as the role of pretreatment with targeted PAH therapy. A specialist roundtable discussion is a highlight of this issue, as it covers the practical aspects of treating patients with CHD and associated PAH. Dr Berman Rosenzweig and her contributors are to be congratulated for their efforts in producing such a wonderful issue of *Advances*.

Ronald J. Oudiz, MD
Editor-in-Chief

Guest Editor's Commentary

Focusing on Pulmonary Arterial Hypertension in Adults with Congenital Heart Disease



This issue of *Advances in Pulmonary Hypertension* focuses on the growing population of adults with congenital heart disease (CHD) and associated pulmonary arterial hypertension (PAH). Although progress in diagnostics and surgical intervention has dramatically decreased the incidence of classic Eisenmenger syndrome in the Western world, these advances have led to a rapidly growing number of adults with CHD and associated PAH.

In this journal edition, the authors highlight some of the considerations and challenges specific to the adult with PAH associated with CHD. Admittedly, there are still more questions than answers for these patients; the authors hope to bring to light some of the important issues that require further study.

Erika Berman Rosenzweig, MD, Guest Editor
Assistant Professor of Pediatrics (in Medicine)
Division of Pediatric Cardiology
Columbia University College of Physicians and Surgeons
New York, New York

Editorial Advisory Board

Editor-in-Chief

Ronald J. Oudiz, MD
Associate Professor of Medicine
UCLA School of Medicine
Director, Liu Center for
Pulmonary Hypertension
Division of Cardiology
Los Angeles Biomedical Research
Institute at Harbor-UCLA
Medical Center
Torrance, California

Immediate Past Editor

Vallerie V. McLaughlin, MD
Associate Professor of Medicine
Director, Pulmonary Hypertension
Program
University of Michigan Health
System
Ann Arbor, Michigan

Editor-in-Chief Elect

Richard Channick, MD
Professor of Clinical Medicine Pulmonary
and Critical Care Division University of
California,
San Diego Medical Center
San Diego, California

Associate Editors

Erika Berman Rosenzweig, MD
Assistant Professor of Pediatrics
Department of Pediatrics
Columbia College of Physicians
and Surgeons
New York, New York

Robert Frantz, MD
Consultant in Cardiovascular
Diseases and Internal Medicine
Assistant Professor of Medicine
Mayo Clinic College of Medicine
Rochester, Minnesota

Srinivas Murali, MD, FACC
Professor of Medicine
Drexel University College of Medicine
Director, Division of
Cardiovascular Medicine
Medical Director, Gerald McGinnis
Cardiovascular Institute
Allegheny General Hospital
Pittsburgh, Pennsylvania

Editorial Board

Todd Bull, MD
Division of Pulmonary Sciences
and Critical Care Medicine
University of Colorado
Health Sciences Center
Denver, Colorado

Murali Chakinala, MD
Director, Pulmonary Hypertension Clinic
Washington University School
of Medicine
St. Louis, Missouri

Kristin Highland, MD
Assistant Professor
Division of Pulmonary and Critical Care
Director, Pulmonary Hypertension Clinic
Medical University of South Carolina
Charleston, South Carolina

Jim Maloney, MD
Associate Professor of Pulmonary and
Critical Care Medicine
University of Colorado Health
Sciences Center
Denver, Colorado

Ioana Preston, MD
Assistant Professor of Medicine
Tufts - New England Medical Center
Boston, Massachusetts

Zeenaat Saffar, MD
Assistant Professor of Medicine
Department of Medicine,
Pulmonary & Critical Care Section
Pulmonary Hypertension Center
Baylo College of Medicine
Houston, Texas

Rajan Saggar, MD
Assistant Professor
Division of Pulmonary and Critical Care
Medicine and Hospitalists
David Geffen School of Medicine
UCLA
Los Angeles, California

Robert Schilz, DO, PhD
Medical Director of Lung Transplantation
and Pulmonary Vascular Disease
University Hospital of Cleveland
Case Western Reserve University
Cleveland, Ohio

Francisco Soto, MD, MS
Assistant Professor
Director, Pulmonary Hypertension
Program
Medical College of Wisconsin
Milwaukee, Wisconsin

Roxana Sulica, MD
Assistant Professor of Medicine
Albert Einstein College of Medicine
Director, Beth Israel
Pulmonary Hypertension Program
Beth Israel Medical Center
New York, New York

Program Description

The mission of *Advances in Pulmonary Hypertension* is to serve as the premiere forum for state of the art information regarding diagnosis, pathophysiology and treatment of pulmonary hypertension. The 2003 Venice revision of the World Health Organization Classification serves as a guide to categories of pulmonary hypertension addressed by the Journal. While focusing on WHO Group 1 PAH, the other categories (Group II, Left heart disease; Group III, Associated with lung disease and/or hypoxemia; Group IV, Thrombotic and/or Embolic Disease; Group V, Miscellaneous) are also addressed. This mission is achieved by a combination of invited review articles, Roundtable discussions with panels consisting of international experts in PH, and original contributions. In addition, a special section entitled "Profiles in Pulmonary Hypertension" recognizes major contributors to the field and serves as an inspiring reminder of the rich and collegial history of dedication to advancing the field.

Objectives

- Provide up to date information regarding diagnosis, pathophysiology and treatment of pulmonary hypertension.
- Serve as a forum for presentation and discussion of important issues in the field, including new paradigms of disease understanding and investigational trial design.
- Recognize and preserve the rich history of individuals who have made major contributions to the field via dedication to patient care, innovative research, and furthering the mission of the PH community to cure pulmonary hypertension.

The Scientific Leadership Council of the Pulmonary Hypertension Association

The scientific program of the Pulmonary Hypertension Association is guided by the association's Scientific Leadership Council. The Council includes the following health care professionals:

David B. Badesch, MD
SLC Chair
University of Colorado
Health Sciences Center
Denver, Colorado

Robyn J. Barst, MD
SLC Immediate Past Chair
Columbia Presbyterian Medical
Center Babies Hospital
New York, New York

Vallerie V. McLaughlin, MD
SLC Vice-Chair
University of Michigan
Health System
Ann Arbor, Michigan

Raymond L. Benza, MD
University of Alabama
Birmingham, Alabama

Todd Bull, MD
University of Colorado
Health Sciences Center
Denver, Colorado

Richard N. Channick, MD
UCSD Medical Center
San Diego, California

C. Gregory Elliott, MD
LDS Hospital
University of Utah
School of Medicine
Salt Lake City, Utah

Karen A. Fagan, MD
Chair, Scientific Sessions
Committee
University of Colorado
Health Sciences Center
Denver, Colorado

Adaani Frost, MD
Baylor College of Medicine
Houston, Texas

Nazzareno Galiè, MD
Università di Bologna
Bologna, Italy

Nicholas S. Hill, MD
Division of Pulmonary, Critical Care
and Sleep Medicine
Tufts-New England Medical Center
Boston, Massachusetts

Marc Humbert, MD
Hopital Antoine Beclere
Clamart, France

Dunbar Ivy, MD
University of Colorado
Denver, Colorado

Anne M. Keogh, MD
St. Vincent's Public Hospital
Sydney, Australia

Michael J. Krowka, MD
Chair, Medical Sessions
Committee
Mayo Clinic
Rochester, Minnesota

David Langleben, MD
Jewish General Hospital
Montreal, Quebec, Canada

James E. Loyd, MD
Vanderbilt University Medical
Center
Nashville, Tennessee

Michael D. McGoon, MD
Chair, PHA Board of Trustees
Pulmonary Hypertension Clinic/
Mayo Clinic
Rochester, Minnesota

Srinivas Murali, MD
Chair, Education Committee
Allegheny General Hospital
Pittsburgh, PA

John H. Newman, MD
Chair, Research Committee
Vanderbilt Medical School
Nashville, Tennessee

Ronald J. Oudiz, MD
Liu Center for Pulmonary
Hypertension
Los Angeles Biomedical Research
Institute
Harbor-UCLA Medical Center
Torrance, California

Marlene Rabinovitch, MD
Stanford University
School of Medicine
Stanford, California

Ivan M. Robbins, MD
Vanderbilt University
Nashville, Tennessee

Julio Sandoval, MD
Cardiopulmonary Department
National Institute of
Cardiology of Mexico
Tlalpan, Mexico

James Seibold, MD
University of Michigan
Health System
Ann Arbor, Michigan

Victor F. Tapson, MD
Division of Pulmonary and
Critical Care Medicine
Duke University Medical Center
Durham, North Carolina

Liaisons

Joy Beckmann, RN, MSN
Chair, PH Resource Network
Torrance, California

Joanne Sperando Schmidt
Patient Liaison

Carol E. Vreim, PhD
Division of Lung Diseases, NHBLI
Bethesda, Maryland

Emeritus Members

Bruce H. Brundage, MD
St. Charles Medical
Center-Bend
Bend, Oregon

Alfred P. Fishman, MD
University of Pennsylvania
Health System
Philadelphia, Pennsylvania

The Mission of the Scientific Leadership Council is to provide medical and scientific guidance and support to the PHA by:

- Developing and disseminating knowledge for diagnosing and treating pulmonary hypertension
- Advocating for patients with pulmonary hypertension
- Increasing involvement of basic and clinical researchers and practitioners

More information on PHA's Scientific Leadership Council and associated committees can be found at:
www.PHAssociation.org/SLC/