

Cardiac Emergencies in Children

A Practical Approach
to Diagnosis
and Management

Ashok P. Sarnaik
Robert D. Ross
Steven E. Lipshultz
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Editors

Ashok P. Sarnaik
Pediatrics, Division of Critical Care
Medicine
Children's Hospital of Michigan & Wayne
State University School of Medicine
Detroit, MI, USA

Steven E. Lipshultz
Pediatrics, Division of Cardiology
Children's Hospital of Michigan & Wayne
State University School of Medicine
Detroit, MI, USA

Robert D. Ross
Pediatrics, Division of Cardiology
Children's Hospital of Michigan & Wayne
State University School of Medicine
Detroit, MI, USA

Henry L. Walters III
Pediatric Cardiovascular Surgery
Children's Hospital of Michigan & Wayne
State University School of Medicine
Detroit, MI, USA

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Foreword 1

You are a pediatrician, a family practice physician, an emergency department physician who sees children, a pediatric hospitalist, a trainee, or a nurse practitioner caring for children and you encounter a cardiac emergency—it's somewhat uncommon and scary. Other than the little experience you receive during training, there are limited resources to help you to navigate the approach to care for such a patient, including no textbooks that focus on this problem, until now.

In this textbook, *Cardiac Emergencies in Children: A Practical Approach to Diagnosis and Management*, the editors and authors cover the pathophysiology of, diagnostic approaches to, and therapeutic rationale for children presenting with life-threatening conditions from a diverse group of congenital and acquired heart lesions, as well as the failing heart. They discuss topics ranging from the emergency presentations and recognition of cardiovascular disease in childhood in countries with resources and those with limited resources, to issues occurring in the child recovering from a surgical repair of congenital heart disease, to the use of mechanical circulatory support and problems seen in children after heart transplantation. In addition, emergencies in children with pulmonary hypertension, inflammatory heart disease, cyanotic heart disease, shunts, and arrhythmias are all detailed, and the practical approaches to their care are described. In delivering the needed information, the editors have utilized the talents of renowned leaders in the field of congenital and acquired heart disease, heart failure, and transplantation, including highly respected pediatric cardiologists and cardiac surgeons, pediatric and cardiac intensivists, and pediatric radiologists. The textbook they have produced will educate a wide variety of clinicians and trainees for many years to come and will become a “go-to” book for the current and future generations of clinicians planning to take care of children at risk for cardiovascular emergencies. Pediatric medicine owes its gratitude to the editors, Drs. Sarnaik, Ross, Lipshultz, and Walters III, as well as the authors of the excellent topical chapters, for their visions, insights, and recommendations which will undoubtedly help to care for children exposed to cardiac emergencies.

Memphis, TN, USA

Jeffrey A. Towbin, M.D.

Foreword 2

Ashok Sarnaik, Robert Ross, Steven Lipshultz, and Henry Walters III have set out to edit a unique book tailored to physicians who might encounter cardiac emergencies in children, but to whom such encounters are not their daily preoccupation. Some note of who these editors are helps to clarify their purpose.

Ashok Sarnaik is a senior pediatric intensivist whose preoccupations include the care of children who suffer cardiac emergencies. In the course of a day's work, he commonly receives transfers from physicians who have provided initial management. He recognizes the challenges they face and the limits to their expertise in this highly specialized clinical area. Robert Ross is a senior pediatric cardiologist with a grand overview and broad expertise in the pathophysiology of pediatric cardiac disease. Steven Lipshultz is a pediatric department chair who is also a senior pediatric cardiologist. As a pediatric department chair, Dr. Lipshultz has a broad overview of the skill sets of non-cardiologist pediatricians and others who see sporadic examples of pediatric cardiac emergencies. Henry Walters III is a pediatric heart surgeon with a broad understanding of the medical and surgical options for children who suffer or are prone to cardiac emergencies.

Together, the editors have undertaken to highlight the background needed to understand the nature of these emergencies, their basis in physiology, and their diagnostic elements and therapeutic options. The topics presented are tailored to the needs of the practitioners who face these challenging crises sporadically: adult and pediatric emergency physicians, hospitalists, primary care physicians, midlevel providers, and nurses.

This text is unique in its targeted readership, scope of content, and level of detail. It is both archival and educational. It can be used both to launch further literature inquiry and to quickly inform in a crisis. It is both problem oriented and diagnostically categorized.

It teaches both what to do and what not to do.

El Paso, TX, USA

Bradley Fuhrman

Preface

“There is no disease more conducive to clinical humility than aneurysm of the aorta.”

Sir William Osler

Facing a critically ill child with a life-threatening cardiac emergency is extremely challenging for first responders. Children with either known or suspected heart disease most often present to an emergency department, including departments that predominantly serve adults, and some may present in a primary care provider’s office. Many of these children have undiagnosed heart disease with congenital or acquired origins. The emergency manifestations of heart disease in a critically ill child can often mimic other common pediatric illnesses such as bronchiolitis, asthma, pneumonia, dehydration, shock, and sepsis, resulting in misdiagnosis and delays in beginning appropriate therapies, delays that can have catastrophic consequences. Also, commonly used therapies such as bronchodilators, fluid expansion, and supplemental oxygen can adversely affect the outcome in some situations.

With advances in surgery techniques, many children with complex congenital heart diseases are surviving with improved life expectancy and quality of life. Some of these children present with emergencies between several stages of cardiac surgical palliation. These patients have unique pathophysiological considerations and require individualized management approaches. Certain therapies that are life-saving in one situation can be paradoxically life-threatening in another. One such example is the potential danger of using supplemental oxygen in an infant who has recently undergone a first-stage Norwood procedure versus its potential benefit when used in that same infant, later in life, after undergoing a completion Fontan procedure. First responders without familiarity in managing such emergencies need a practical guide on how to quickly evaluate, stabilize, and initiate treatment on these patients and to know when to get immediate cardiology consultation.

Historically, pediatric cardiovascular surgery has often been limited in the developing world where children with heart disease received only supportive care. This is no longer the case; patients with heart defects such as septal defects, valvar stenoses, and vascular anomalies are now routinely operated on in developing countries. Even cardiac transplantation is now available with great success in many parts of the developing world. Thus, a normal life expectancy is an attainable goal for many

such children. At the same time, with increasing globalization and international travel, technologically advanced countries have much to learn from countries with limited resources about cardiac involvement in conditions that are uncommon to them, such as vitamin D deficiency cardiomyopathy and dengue myocarditis. The authors of the chapter “Cardiac Emergencies in Countries with Limited Resources” have addressed some of the special challenges they routinely face in their practice.

In this book on pediatric cardiac emergencies, we attempt to bridge the gap between cardiac critical care subspecialists and the emergency care providers in various settings. The goal is to provide the pathophysiological basis of cardiac dysfunction, improve clinical reasoning to facilitate the diagnosis, and explain the rationale for stabilizing and managing cardiac emergencies in children. We emphasize the importance of history and physical examination and interpreting ECG and chest radiographs and describe situations where there is a need to consult subspecialists. We do so by presenting real-life case scenarios and practical guidelines.

This book is aimed primarily at pediatric and adult emergency physicians who do a yeoman’s work in diagnosing and stabilizing patients. Primary care physicians and pediatric hospitalists who encounter cardiac emergencies in their practice will also find the information valuable. The book will also be beneficial for nurses and physicians at all levels of training including students, residents, fellows, and other health-care professionals.

Finally, we must acknowledge that this book is a result of true team effort. Experts from various institutions and specialties have willingly and selflessly provided their knowledge and expertise with the sole purpose of improving outcomes of children with heart disease throughout the world. We thank them from the cockles of our hearts!

Detroit, MI, USA
Detroit, MI, USA
Detroit, MI, USA
Detroit, MI, USA

Ashok P. Sarnaik
Robert D. Ross
Steven E. Lipshultz
Henry L. Walters III

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