

PROBLEMS in PEDIATRIC EMERGENCY MEDICINE

Edited by

Robert C. Luten

CONTEMPORARY ISSUES
in EMERGENCY MEDICINE

SERIES EDITOR

Ann Harwood-Nuss

06023

RT20.9

L973

PROBLEMS in PEDIATRIC EMERGENCY MEDICINE

Edited by

Robert C. Luten, M.D.

Associate Professor and Director
of Pediatric Emergency Services
Division of Emergency Medicine
Department of Surgery

University of Florida College of Medicine
Gainesville, Florida

Director of Pediatric Emergency Services
University Hospital of Jacksonville
Jacksonville, Florida

馆藏专用章

CHURCHILL LIVINGSTONE
New York, Edinburgh, London, Melbourne 1988



Library of Congress Cataloging-in-Publication Data

Problems in pediatric emergency medicine / edited by Robert C. Luten.

p. cm. — (Contemporary issues in emergency medicine)

Includes bibliographies and index.

ISBN 0-443-08579-X

1. Pediatric emergencies. 2. Pediatric intensive care.

I. Luten, Robert C. II. Series.

[DNLM: 1. Emergency Medicine—in infancy & childhood. WS 200 P962]

RJ370.P76 1988

618.92'0025—dc19

DNLM/DLC

for Library of Congress

88-4302
CIP

© Churchill Livingstone Inc. 1988

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, without prior permission of the publisher (Churchill Livingstone Inc., 1560 Broadway, New York, N.Y. 10036).

Distributed in the United Kingdom by Churchill Livingstone, Robert Stevenson House, 1-3 Baxter's Place, Leith Walk, Edinburgh EH1 3AF, and by associated companies, branches, and representatives throughout the world.

Accurate indications, adverse reactions, and dosage schedules for drugs are provided in this book, but it is possible that they may change. The reader is urged to review the package information data of the manufacturers of the medications mentioned.

The Publishers have made every effort to trace the copyright holders for borrowed material. If they have inadvertently overlooked any, they will be pleased to make the necessary arrangements at the first opportunity.

Acquisitions Editor: *Kim Loretucci*

Copy Editor: *Kathleen Carroll*

Production Designer: *Melanie Haber*

Production Supervisor: *Jocelyn Eckstein*

Printed in the United States of America

First published in 1988

To my son Rocky,
to whom I am forever committed.

To Mary,
who has been my best friend.

CONTRIBUTORS

Jorge E. Alonso, M.D.

Assistant Professor, Department of Orthopaedics, University of Florida College of Medicine, Gainesville, Florida; Attending Orthopaedic Surgeon, Department of Orthopaedic Surgery, Jacksonville Health Education Program, University Hospital of Jacksonville, Jacksonville, Florida

Roger M. Barkin, M.D., M.P.H.

Associate Professor, Departments of Pediatrics and Surgery, University of Colorado Health Sciences Center; Chairman, Department of Pediatrics, and Director, Pediatric Emergency Services, Rose Medical Center, Denver, Colorado

Thomas R. Caraccio, Pharm.D.

Visiting Assistant Professor, Departments of Pharmacology and Toxicology, New York College of Osteopathic Medicine, Westbury, New York; Adjunct Clinical Assistant Professor, Department of Pharmacology, St. John's University College of Pharmacy, Jamaica, New York; Coordinator, Long Island Regional Poison Control Center, East Meadow, New York

Stephen Ludwig, M.D.

Associate Professor, Department of Pediatrics, University of Pennsylvania School of Medicine; Director, Emergency Services, Children's Hospital of Philadelphia; Educational Coordinator, Support Child/Adult Network Inc., Philadelphia, Pennsylvania

Robert C. Luten, M.D.

Associate Professor and Director of Pediatric Emergency Services, Division of Emergency Medicine, Department of Surgery, University of Florida College of Medicine, Gainesville, Florida; Director of Pediatric Emergency Services, University Hospital of Jacksonville, Jacksonville, Florida

Howard C. Mofenson, M.D.

Professor, Department of Clinical Pediatrics, State University of New York at Stony Brook Health Sciences Center School of Medicine, Stony Brook, New York; Director, Long Island Regional Poison Control Center, Nassau County Medical Center, East Meadow, New York

Kim A. Ogle, M.D.

Associate Director, Pediatric Emergency Services, University Hospital of Jacksonville, Jacksonville, Florida

Robert Schafermeyer, M.D.

Clinical Associate Professor, Department of Pediatrics, University of North Carolina at Chapel Hill School of Medicine, Chapel Hill, North Carolina; Director, Emergency Medicine Residency Program, Charlotte Memorial Hospital and Medical Center, Charlotte, North Carolina

Jay L. Schauben, Pharm.D.

Clinical Assistant Professor, Departments of Pharmacy and Emergency Medicine, University of Florida College of Medicine, Gainesville, Florida; Coordinator, Clinical Toxicology Services, University Hospital of Jacksonville, Jacksonville, Florida

Steven M. Selbst, M.D.

Assistant Professor, Department of Pediatrics, University of Pennsylvania School of Medicine; Associate Director, Emergency Services, Children's Hospital of Philadelphia, Philadelphia, Pennsylvania

Joseph Simon, M.D.

Director, Emergency Services, Scottish Rite Children's Hospital, Atlanta, Georgia

Jonathan I. Singer, M.D.

Associate Professor, Departments of Emergency Medicine and Pediatrics, Wright State University School of Medicine, Dayton, Ohio

Fred Tecklenburg, M.D.

Assistant Professor, Department of Pediatrics, and Director, Division of Emergency/Critical Care, Medical University of South Carolina College of Medicine, Charleston, South Carolina

Joseph J. Tepas III, M.D.

Associate Professor, Division of Pediatric Surgery, Department of Surgery, University of Florida College of Medicine, Gainesville, Florida; Director, Pediatric Trauma Services, University Hospital of Jacksonville, Jacksonville, Florida

FOREWORD

The new series, *Contemporary Issues in Emergency Medicine*, has been created to fill a number of needs in the medical literature. Our goal is to produce bi-annual, in-depth volumes addressing major clinical topics in emergency medicine.

I have selected volume editors based on a personal bias that favors those individuals intimately familiar with the complexities and scope of clinical emergency medicine. Volume topics have been selected based on a number of factors, but the dominant feature is that each represents a clinical issue which is recognized as major and problematic for the practicing emergency physician. The text will be a blend of didactic and practical information organized in a format designed to enhance clinical application. The chapter format will be consistent, featuring discussions on differential diagnosis, clinical manifestations, emergency department evaluation and management, the use of routine and special studies, indications for admission, the role of sub-specialty consultants, and finally, proper disposition with emphasis on recommendations for followup, referral, or transfer.

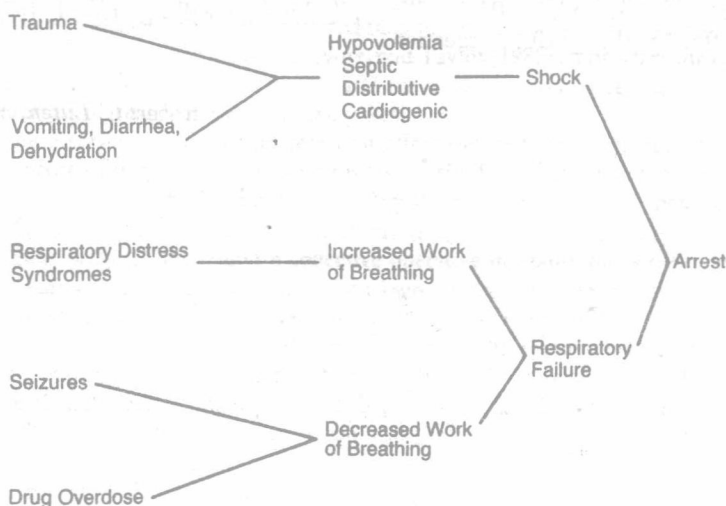
In summary, there exists a variety of methods available for the acquisition and maintenance of current knowledge. However, each of these has its limitations. The advantages of a biannual volume devoted to a specific clinical issue are timely publication and in-depth review of a major topic, blended with practical recommendations for a patient care. I would hope that our series will be used as both a major resource for understanding a specific topic, as well as a clinical tool in the care of the emergency patient.

Ann Harwood-Nuss, M.D.

PREFACE

The entity of pediatric emergency care has been evolving rapidly within the specialties of emergency medicine and pediatrics. This is appropriate since both specialties are involved in the care of children and will continue to be involved in the future. Although research is needed in this area, there is already a wealth of existing knowledge and experience within the two parent specialties. This book consolidates elements of this body of knowledge into a functional educational package written by thoughtful, creative authors.

There are many common disease entities which account for the majority of morbidity and mortality in children. These entities follow two common pathways: shock and respiratory failure. If allowed to progress unabated, both of these pathways terminate in cardiac arrest.



Whereas pediatric life support courses have concentrated more on terminal endpoints as shown on the right half of the above figure, this particular text concentrates more on the presenting symptoms or diseases as shown on the left side. In addition to these specific areas, general topics related to the management of pediatric emergencies are also included.

In this volume the authors address specifically the most difficult or problematic areas related to each disease entity rather than take the more traditional, all-inclusive academic approach to a given topic. Hopefully clinicians will find this volume not only interesting reading but essential to their daily practice of emergency medicine. The book is divided into three sections. The first section deals with general concerns related to pediatric emergency medicine. The chapter on recognition of the sick child serves as an introduction to the book and is followed by guidelines for the use of laboratory studies in the evaluation of the pediatric patient and a chapter on how to optimize the care of children in situations which might be less than optimal. This is followed by a chapter on medical-legal considerations in dealing with pediatric emergencies and a thoughtful chapter on the global problem of child abuse in our society. The subsequent material is divided into a trauma section and a medical section. Included for completeness along with multiple trauma is a chapter on minor trauma and also chapters on evaluation of the pediatric cervical spine and pediatric fractures. Included in the medical section are chapters on the management of dehydration (a frequent precursor of shock), as well as common disease entities of the respiratory failure pathway, specifically seizures, ingested toxins, and respiratory distress syndromes.

It is the intent of this volume to focus on clinical problems related to the care of the pediatric patient in the emergency situation. I wish to thank all the contributors for their untiring and diligent efforts to accomplish this goal. I also wish to acknowledge Ms. Jo-Reid Nichols for her help in preparing this volume and Dr. Robert Wears for his ever-willing attitude to help and offer his thoughtful suggestions.

Robert C. Luten, M.D.

CONTENTS

General Section

1. Recognition of the Sick Child 1
Robert C. Luten
2. Problems in the Use of the Laboratory 13
Joseph Simon
3. Optimizing Pediatric Emergency Care with
Sub-optimal Resources 29
Joseph Simon
4. Medical-Legal Aspects 45
Steven M. Selbst
5. Child Abuse: Causes and Solutions 61
Stephen Ludwig

Trauma Section

6. Problems in the Management of Multiple
Trauma 71
Joseph J. Tepas III

- | | |
|---|-----|
| 7. Problems in Minor Trauma Care
Robert Schafermeyer | 93 |
| 8. Problems in Managing Cervical Spine Injuries
Fred Tecklenburg | 111 |
| 9. Problems in Fracture Management
Jorge E. Alonso | 141 |

Medical Section

- | | |
|---|-----|
| 10. Problems in the Management of Vomiting,
Diarrhea, and Dehydration
Roger M. Barkin | 173 |
| 11. Problems in the Management of Seizures
Jonathan I. Singer | 189 |
| 12. Problems in the Management of Respiratory
Distress
Kim A. Ogle | 219 |
| 13. Problems in the Management of Intoxications
Jay L. Schauben, Howard C. Mofenson, and Thomas R.
Caraccio | 245 |

- | | |
|-------|-----|
| Index | 279 |
|-------|-----|

Recognition of the Sick Child

1

Robert C. Luten

Recognition of serious disease is critical to the timely initiation of effective treatment. Recognition encompasses knowledge not only of the presence of disease but, in many cases, of the progression of disease from a relatively benign form to a potentially more severe form. The most sophisticated of treatment modalities are useless if one does not realize the need for their application. This chapter provides an overview of the process of evaluation and recognition of disease in children. It focuses first on the primary caretaker of children in the emergency situation and that person's unique capabilities. Second, we look at the patient who is being evaluated and the spectrum of disease and clinical dilemmas that this patient presents. Last, we examine the process by which this evaluation is accomplished. This chapter serves as an introduction to subsequent chapters that deal with specific disease entities.

THE PRIMARY CARETAKER OF CHILDREN

As of 1985, approximately 5,500 undifferentiated emergency departments saw approximately 75 million patients per year. One-third of these patients, or approximately 25 million, were children. This is in stark comparison to the number of free-standing pediatric emergency departments (50), and the number of patients seen in these emergency departments (approximately 1.5 million) (National Association of Children's Hospitals and Related Institutions, American College of Emergency Physicians, personal

communications). Even if one includes all pediatric residency programs whose emergency departments might or might not be staffed by pediatricians 24 hours a day, the total proportion of children seen initially by pediatricians is still small. Over the past few years, these numbers have changed little, and it remains a fact that the overwhelming majority of children are seen initially in an undifferentiated emergency department, and by nonpediatricians. It is the opinion of this author and others¹ that the two types of physicians who are the primary caretakers of children—pediatricians and emergency physicians—differ in their ability to take care of pediatric emergencies. Emergency physicians are very good at treating obvious emergencies, such as cardiac arrest. They are also capable in airway management and other procedural emergencies; however, they may lack some of the recognition skills needed to manage more subtle emergencies; for example, they may have difficulty identifying early meningitis or early dehydration in a child with vomiting and diarrhea. Pediatricians, on the other hand, are very good at recognizing these subtle emergencies—i.e., have good recognition skills—but tend to be deficient at trauma care and some of the procedural and obvious emergencies (Table 1-1).

It was recently noted that the training in some emergency medicine programs was deficient in coverage of pediatric emergencies.² This has been recognized as a problem by emergency physicians and has been addressed with the proposal of an expanded curriculum,³ expansion of the study guide in emergency medicine, and a cooperative effort between the American College of Emergency Physicians (ACEP) and the American Academy of Pediatrics (AAP) to improve the care of children through the development of an advanced pediatric life-support course. There is also some evidence that the care of infants with severe illness by emergency physicians may be similar to the standard of care that would have been given by pediatricians in certain circumstances.⁴

The AAP has also dedicated its effort to improve the pediatrician's ability to care for the emergent pediatric patient. Besides the cooperative efforts mentioned above, some 15 pediatric emergency medicine fellowship programs have been developed, most of which are based in pediatric programs and which address the needs of pediatricians to care for children with emergent problems.

In the future, economic forces will probably support expansion of facilities dedicated exclusively to the care of children. These facilities will probably be staffed by physicians specifically trained to take care of pediatric

Table 1-1. Relative Strengths and Weaknesses of the Primary Caretakers of Children in Emergency Situations

	Emergency Medicine	Pediatrics
Strengths	Obvious emergencies Procedural emergencies	Subtle emergencies (recognition skills)
Weaknesses	Subtle emergencies (recognition skills)	Trauma Obvious emergencies Procedural emergencies

emergencies. This raises the question, Who is better equipped to take care of children?—the emergency physician who is an expert at emergencies but who rarely sees critically ill children, or the pediatrician who is an expert in the care of children but who rarely manages emergencies? The question is probably moot. Even with expansion of purely pediatric facilities, children will always be cared for in both environments and by both types of physicians. It would be impossible to separate out all children and direct them to a pure pediatric facility. Indeed, the bulk of children will still be cared for by the general emergency physician in the future. It is for this reason that cooperation must exist between the two parent organizations, ACEP and AAP; more importantly, educational efforts directed toward the emergency care of children should be directed at the needs of both types of caretakers.

THE PATIENT

In defining the emergent pediatric patient, we must consider first the spectrum of the normal progression of disease and then look specifically at the clinical problems encountered by the physician caring for children with these diseases.

The Spectrum of Disease

Most pediatric illnesses are benign and self-limited. Of those that do progress further, there are two common pathways—shock syndromes and respiratory failure syndromes—both of which, if allowed to progress, will result in cardiac arrest (Fig. 1-1). The emergency physician is presented with an extremely diverse patient population; the primary job is to pick out the sick child or the child with a potentially serious disease from this large group of undifferentiated patients. Second, and equally important, the emergency physician must be able to recognize when a given patient is progressing further into shock or respiratory failure, necessitating intervention to prevent further progression to the arrest state. Once a child has arrested, the physician's primary responsibility is to optimize resuscitative techniques in an effort to increase survival and produce a good neurologic outcome. Over the past few years, strides have been made in educational efforts centering around the two final common pathways, diseases associated with these pathways, and the management of the patient in cardiac arrest (APLS course). This volume takes one step backward to the recognition of the child who is at risk of progression or sick, followed by recognition of the further progression of these children to a more serious form of their disease. Only when the child is recognized as being different from the undifferentiated patient or as being sick can diagnostic workup and therapy be begun. This same principle applies to the treatment of shock or respiratory failure; that is, it can only be initiated if the clinician recognizes that this syndrome is developing in a given patient.

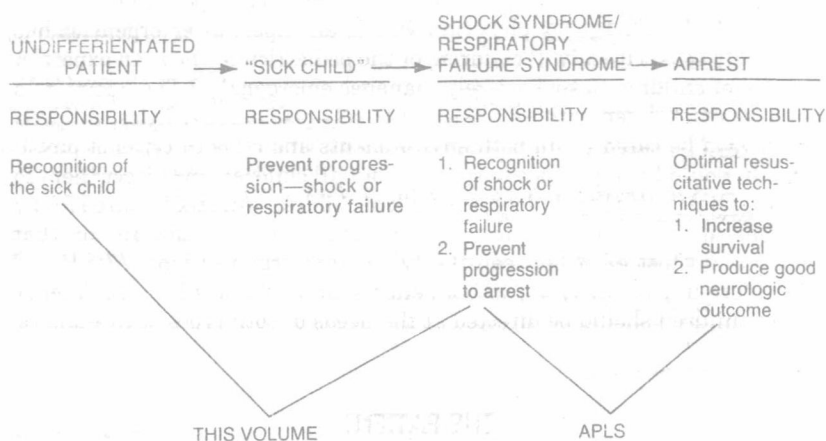


Fig. 1-1 Potential progression of the undifferentiated pediatric patient. Note caretaker's responsibility at each point in the progression.

The Clinical Problem

The term *sick child* is an arbitrary one. From the standpoint of clinical decision-making, and for purposes of this chapter, it covers that group of patients who appear to have the potential for progression to a serious outcome if left untreated. They usually require either some sort of further evaluation or consultation, or both, for ultimate disposition (Table 1-2). From a clinical point of view, we can exclude from the sick group some subsets of patients. The child with a runny nose who is running around the room laughing and screaming, who otherwise does not have any risk factors, such as temperature elevation or age (temperature greater than 104°F, age less than 2 years old), is obviously not sick. Some of these children might require some degree of laboratory evaluation prior to disposition, but it is usually rather clear cut, or the laboratory is only confirmatory in nature, for example, the well-appearing infant with a positive chest radiograph. The obviously severely ill child should also be excluded, i.e., the moribund, comatose infant because, although he is severely ill and has the potential for progression to a poor outcome, he does not represent a recognition problem and appropriate therapy is not delayed. The final exclusion is the child who might appear well but who we know is at high risk of a serious disease, as determined by certain risk factors. These children usually do not pose a clinical recognition problem, since they are recognized by virtue of their risk factors. An example would be a sickle cell patient with a high fever or the newborn infant with a low-grade fever. Once identified, the evaluation, treatment, and disposition are relatively straightforward in most cases. The key is knowledge of the high-risk categories. The pediatrician tends to be cognizant of these high-risk patients, and the emergency physician to a

Table 1-2. Subgroups of Children Presenting as Sick

Group 1

Severe form of common, usually benign disease

Example: Gastroenteritis that progresses to dehydration and shock

Appropriate treatment and follow-up can reduce the number of patients in this category.

Early recognition of progression of disease and appropriate intervention are keys to reducing morbidity and mortality. All these entities are heralded by logical progression of events or warnings. Problems particular to common diseases in this category are presented in subsequent chapters.

Group 2

Early form of a serious disease

Example: meningitis^a

Child who appears clinically ill and requires further diagnostic intervention to formulate a diagnosis (irritable infant who has a positive LP)

These ill-appearing children do not improve with observation and ultimately have specific diagnosis confirmed by laboratory evaluation (positive LP).

Group 3

Child who appears clinically ill, but for whom serious disease is ruled out by evaluation

Example: a negative LP

(fussy infant who has a negative LP)

These children represent the bulk of children clinically classified as sick. Even though, they are by definition retrospectively classified. They usually require some sort of evaluation (LP), observation, or consultation for ultimate disposition. The size of this subset is inversely proportional to one's clinical experience with children.

^a The exception is the child who appears clinically well, but who later develops serious disease. These occult conditions are currently the subject of much research and investigation. Many of these children may therefore fall into the category defined as high risk by virtue of age and temperature elevation (less than 2 years, temperature greater than 104°F).

lesser extent. Conversely, there are patients with whom the pediatrician is relatively unfamiliar and with whom the emergency physician has more experience. An example would be the patient who ingests a tricyclic antidepressant who, unlike other overdose patients, is at extremely high risk of rapid deterioration and needs more expeditious intervention than the routine overdose (i.e., immediate lavage versus the slower decontamination route using ipecac).

In the ill-appearing or sick group, three patient categories tend to be identified. The first is a severe form of a common, usually benign disease, such as gastroenteritis that may be progressing to dehydration and shock. The second is an early form of a serious disease, such as meningitis (see

Table 1-2). The child appears clinically ill and requires further diagnostic intervention to arrive at the correct diagnosis. An example would be the irritable infant who has a positive lumbar puncture. For the first group, appropriate treatment and follow-up of the disease on initial presentation can reduce the number of patients in this category. Early recognition of progression of disease and appropriate intervention are the keys to prevention of morbidity and mortality. All the entities in the first group are heralded by a logical progression of events or warnings. An example would be the infant who presents with vomiting and diarrhea. We know that if the process does not resolve, there is potential for progression to dehydration and then to shock. The clinician is thus alerted to the potential pathway a given patient might follow; this aids in the recognition of that progression. Problems particular to many of these common diseases and their recognition are presented in subsequent chapters. The second group, children with early forms of serious disease, do not improve with observation and usually have their ultimate specific diagnosis confirmed by laboratory evaluation. An obvious exception to this group has been the subject of much research over the past few years—the child who has a serious disease but who appears clinically well. These occult conditions are well described in the pediatric literature. Many authorities would classify these children in the high-risk group, that is, as children who appear well but who may be defined as high risk by virtue of certain risk factors, such as age and temperature (under 2 years of age and having a temperature above 104°F). Some consider laboratory evaluation clinically useful in identifying these patients. The chapter on laboratory use addresses this issue.

The third category of ill-appearing children includes those who appear clinically ill but for whom serious disease is ruled out by subsequent evaluation. An example would be a fussy infant who has a negative lumbar puncture. This group represents the bulk of children initially classified clinically as sick. These infants usually require some sort of evaluation, such as lumbar puncture, observation, or consultation for ultimate disposition. The size of this last subset of patients is usually inversely proportional to the physician's clinical experience with children (Fig. 1-2). The more experience a clinician has with children, the more easily he or she can decide, on a clinical basis, whether a child looks well or severely ill and the smaller the proportion of sick children or children requiring further evaluation. This reduction in the total number of sick children is therefore the result of reducing the size of group 3. It also follows logically that the physician who is less familiar with children will rely on more laboratory tests (with a higher percentage of negative lumbar punctures and chest radiographs) than will the more experienced physician. The fact that group 3 is large and even outnumbers the number of patients with serious disease should not be necessarily alarming to the physician caring for children. Several studies have demonstrated the need for acceptance of a high degree of initial false-positive results in the clinical assessment of ill-appearing children in order to pick up the acceptable percentage of truly sick infants.⁵ Further evidence is demonstrated by the fact that the vast majority of lumbar punctures done