

ROSEN'S

EMERGENCY MEDICINE

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7th EDITION

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EMERGENCY MEDICINE

CONCEPTS AND CLINICAL PRACTICE

Volume 1

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We wish to dedicate this 7th edition to Peter Rosen, MD, the founder of this textbook and its Editor-in-Chief through the first four editions. Thirty-one years ago, in 1978, Peter came to the belief that an emergency medicine textbook should be written by emergency physicians, and 5 years later, in 1983, he was the first to carry out that mission when the inaugural edition of this textbook was published. While this eponymous work is significant, Peter is more widely acknowledged as one of the true fathers of academic emergency medicine. He continues to leave his imprimatur on numerous programs and innumerable medical students, residents, and faculty members throughout the country and indeed the world. Many of these individuals, like ourselves, have tried to emulate his unbending leadership, his passion for teaching, and his reverence for emergency medicine and the patients we have the great privilege to serve.

This textbook represents just one of many exemplary accomplishments of one extraordinary man. We are indebted to Peter for his vision and his wisdom. We are unspeakably grateful for the honor of continuing this work, ever humbled by the responsibility of carrying his legacy forward, and beholden to him for helping craft our specialty into what it is today.

*John A. Marx
Robert S. Hockberger
Ron M. Walls*

How this Medical Textbook Should Be Viewed by the Practicing Clinician and the Judicial System

The editors and authors of this textbook strongly believe that the complex practice of medicine, the vagaries of human diseases, the unpredictability of pathologic conditions, and the functions, dysfunctions, and responses of the human body cannot be defined, explained, or rigidly categorized by any written document. *Therefore, it is neither the purpose nor intent of our textbook to serve as an authoritative source on any medical condition, treatment plan, or clinical intervention, nor should our textbook be used to rigorously define a standard of care that should be practiced by all clinicians.*

Our written word provides the physician with a literature-referenced database, and a reasonable clinical guide, which is combined with practical suggestions from individual experienced practitioners. We offer a general reference source and clinical roadmap on a variety of conditions and procedures that may confront clinicians who are experienced in emergency medicine practice. This text cannot replace physician judgment; cannot describe every possible aberration, nuance, clinical scenario, or presentation; and cannot define rigid standards for clinical actions or procedures. *Every medical encounter must be individualized, and every patient must be approached on a case-by-case basis.* No complex medical interaction can possibly be reduced to the written word. The treatments, procedures, and medical conditions described in our textbook do not constitute the total expertise or knowledge base expected to be possessed by all clinicians. Finally, many of the described complications and adverse outcomes associated with implementing or withholding complex medical and surgical interventions may occur, even when every aspect of the intervention has been standard or performed correctly.

The editors and authors of *Rosen's Emergency Medicine: Concepts and Clinical Practice*, 7th Edition

From Roberts JR, Marx JA: Position Statement: Use of Medical Textbooks in Malpractice Claims. *Emerg Med News*, Vol. XXXI, 2:3, February 2009.

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Preface to the Seventh Edition

We are pleased to provide this 7th edition of *Rosen's Emergency Medicine: Concepts and Clinical Practice*, now in its 28th year of existence, and wish to recite several changes intended to enhance its content, readability, and purpose. The textbook has been converted into two volumes and reduced in size by more than 500 pages. This was accomplished with judicious editing but mostly through the transfer of the entire bibliography onto the book's website at expertconsult.com, where the full text is available online, along with an image library, Q&A, and updates. The number of chapters is virtually unchanged while the number of annotations per chapter has been expanded. More importantly, we have strived to render the textbook as strongly evidenced based as possible through reliance on the vigilant selection of high-quality and recent references. We will continue to add online updates, wherein recent journal articles selected by the senior editors are abstracted and electronically plugged into the margins of the relevant area of the existing web-based version of the book. We also have the good fortune of adding numerous authors who are authoritative in the subjects about which they write as well as a new team that has composed a Question and Answer com-

pendium. Much of the artwork and the format have been reworked and many of the photographs, including radiographs, have been updated.

We are grateful to many. The authors have committed their many hours and substantive expertise to lay the foundation. The editors have performed yeoman's work to maintain consistency in templating each chapter and to help assure accuracy and clarity. We thank Judy Fletcher, our Publishing Director; Stefanie Jewell-Thomas, our Acquisitions Editor; and Dee Simpson, our Developmental Editor; for listening thoroughly and suggesting wisely and for all their work behind the scenes. We are most appreciative for the terrific support from our administrative assistants, Tricia Wyatt and Gail Franklin (JAM), Maria Figueroa (RSH), and Diane Pugh and Janice Bingham (RMW). We could not have committed the requisite time and energy to this labor of great love were we without the encouragement and buoying up from our families. Finally, we thank you, Peter, for making all this possible just because you chased a dream three decades ago.

*John A. Marx
Robert S. Hockberger
Ron M. Walls*

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Preface to the First Edition

From the vision and foresight of a few physicians who perceived the need for a unique, disciplined, sensitive approach to the identification and stabilization of patients threatened with loss of life or limb, emergency medicine has rapidly developed into an exciting, academically recognized medical specialty. This textbook is dedicated to those who have accepted its responsibilities, challenges, and excitements.

We have attempted to define in depth the material on which our practice is based. There have been a number of efforts to write about emergencies, but we believe that this is the first to call solely on those people who themselves practice the specialty. In every chapter theory and knowledge pertinent to the practice of emergency medicine are presented.

This book is not an easy one; it was written based on published literature, not anecdote or prejudice. In many instances where the data are not available, both sides are presented with a suggested practice. The book is intended for all with a serious interest in or a need to know emergency medicine, including those who do not practice full-time emergency medicine, as well as the dedicated specialists who do.

The book is organized into two main sections—trauma and nontrauma. This division is artificial but does correspond to the first major decisions made in patient evaluations, because trauma usually affects individual anatomic structures, whereas nontrauma is more likely to affect systems.

Despite this artificial separation, long and detailed discussion and instruction to authors concerning content and style

ensued. We realize that we could not tap all available talent for contributions to the book, but we have made an effort to represent different schools of thought and regions of the country.

There are deliberate omissions; for example, we elected not to include any procedures. There was not enough room to create an atlas, but it was our desire to cover the chosen topics in detail. No effort has been made to address administration, management, disaster planning, or technical requirements of emergency medicine supplies or design. Prehospital care has been included only as it related to individual topics, not as suggested protocol or from the vantage point of technician training programs.

It would be impossible to write a book this long and present nothing controversial. In fact we ourselves find sections we cannot totally accept, but in the process of working with multiple authors, we cannot with intellectual honesty put ideas into their material. We have, however, achieved our goal of presenting an in-depth vision of emergency medicine. We hope you will find the reading of this book as stimulating and enjoyable as we have found in its creation.

*Peter Rosen
Frank J. Baker II
G. Richard Braen
Robert H. Dailey
Richard C. Levy*

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JAM

To my mentors, my colleagues, and my students, who together comprised my professional family over the past 30 years, for their inspiration, friendship, and support; and to Patty, who brought beauty, love, and balance to my life.

RSH

With humble thanks to Peter, for his enduring friendship, for his great vision in the creation of an extraordinary specialty, and for his selfless mentorship of so many of its present and future leaders; to John and Bob, for being the engine of this amazing and rewarding collaboration; to the editors and authors, who give so freely of their precious time to help to bring so much to so many; to my amazingly resilient, loving, and supportive wife, Barb, and to my children, Andrew, Blake, and Alexa, whose love and intellectual energy inspire me.

RMW

To my father, James J. Adams, whose strength will forever inspire me; to my mother, Rita A. Adams, whose devotion to family will forever guide me; and to the many other members of my family: Cecelia, Joe, Jeff, Liz, Rob, David, Nicholas, Gregory, Leah, Katherine, Sydney, and Trent, whose support I rely on.

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To all my former residents over the past 28 years from both Cincinnati and Michigan. I have been privileged to work with the best and I have learned a lot from all of you. I have to thank my children, David, Blake, and Anna, for keeping me thinking young and teaching me lots about life and family. Most of all, thanks to my wife and best friend, Mary, for her love and support over the past 33 years. She makes it all worthwhile.

WGB

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MHB

To Joanna, Megan, and Julia and our dual-phase marriage; kind of “pre-Rosen” and now four editions together. May you never be tempted to join the literary “first-wives club.”

DFD

I dedicate this book to my husband, David, and our children, Sarah, Jeremiah, and Katie—for their patience, love, and support.

MGH

To emergency medicine residents and faculty everywhere in their constant pursuit of knowledge but especially those at Hennepin County Medical Center for continuing to teach me. I am grateful to my parents, Rose and Joseph, for their commitment to education. Special thanks to Eric, Ali, Amanda, and, most of all, Beth for their love, patience, and understanding.

LJL

I would like to thank my teachers—my parents and my children, professors and patients, colleagues and students—who have patiently taught me about medicine and life; and my steadfast companion and wife, Lynda, who has made the pursuit of wisdom possible.

EJN

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PART I

Fundamental Clinical Concepts

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