

Ecografia Point-of-Care

NILAM J. SONI, MD, MS

Professor of Medicine, Division of General & Hospital Medicine and Division of Pulmonary & Critical Care Medicine, University of Texas Health San Antonio, San Antonio, Texas

ROBERT ARNTFIELD, MD, FRCPC

Associate Professor of Medicine, Division of Emergency Medicine and Division of Critical Care Medicine, Schulich School of Medicine & Dentistry, Western University, London Health Sciences Centre, London, Ontario, Canada

PIERRE KORY, MD, MPA

Associate Professor of Medicine, Division of Allergy, Pulmonary, and Critical Care Medicine, University of Wisconsin School of Medicine and Public Health, Madison, Wisconsin

Edizione italiana sulla seconda in lingua inglese a cura di

ESTERITA ACCOGLI

ANDREA DOMANICO

LUNA GARGANI

GIOVANNI VOLPICELLI

PICCIN

POINT-OF-CARE ULTRASOUND, SECOND EDITION

ISBN 978-0-323-54470-2

Copyright © 2020 by Elsevier, Inc. All rights reserved, including those for text and data mining, AI training, and similar technologies.

Publisher's note: Elsevier takes a neutral position with respect to territorial disputes or jurisdictional claims in its published content, including in maps and institutional affiliations.

This edition of *Point-of-Care Ultrasound, 2nd edition* by **Nilam J. Soni, Robert Arntfield,** and **Pierre Kory**, is published by arrangement with Elsevier Inc.

Questa edizione di *Point-of-Care Ultrasound, 2nd edition* di **Nilam J. Soni, Robert Arntfield** e **Pierre Kory** è pubblicata su licenza di Elsevier, Inc.

La **traduzione** del volume è stata effettuata a cura di **PICCIN NUOVA LIBRARIA S.p.A.** e sotto la sua responsabilità. I professionisti del settore sanitario, i ricercatori e lettori in genere del testo devono sempre basarsi sulla loro esperienza e le loro conoscenze quando prendono in considerazione e usano qualsiasi informazione, metodo, composto o esperimento qui descritto. Poiché le scienze mediche sono in continua evoluzione, si raccomanda, in particolare, la verifica autonoma delle diagnosi e del dosaggio dei medicinali. Elsevier, gli Autori, curatori o collaboratori non si assumono alcuna responsabilità per quanto riguarda la **traduzione** o per qualsiasi lesione e/o danno dovesse venire arrecato a persone o beni per negligenza o altro, oppure uso od operazioni di qualsiasi metodo, prodotto, istruzione o idea contenuti in questo libro.

PICCIN NUOVA LIBRARIA S.p.A. desidera precisare che qualsiasi opinione espressa in questo libro dai singoli Autori o Collaboratori è personale e non riflette necessariamente il punto di vista/l'opinione dell'Editore. Le informazioni o le indicazioni contenute in questo libro sono destinate all'uso da parte di professionisti del settore sanitario e/o scientifico e sono fornite esclusivamente come integrazione del giudizio del medico o di altri professionisti, della loro conoscenza dell'anamnesi del paziente, delle istruzioni del produttore e delle linee guida appropriate. Qualsiasi informazione o consiglio su dosaggi, procedure o diagnosi deve essere verificata in modo autonomo sotto stretta sorveglianza specialistica e attenendosi alle istruzioni per l'uso e alle controindicazioni contenute nei foglietti illustrativi. Questo libro non indica se un particolare trattamento sia appropriato o adatto a un determinato individuo.

In ultima istanza, è responsabilità esclusiva del professionista sanitario formulare il proprio giudizio professionale, in modo da consigliare e trattare i singoli pazienti in modo adeguato.

Opera coperta dal diritto d'autore – Tutti i diritti sono riservati, inclusi quelli relativi a TDM (text and data mining), al training dell'intelligenza artificiale e/o di tecnologie similari.

Questo testo contiene materiale, testi ed immagini, coperto da copyright e non può essere copiato, riprodotto, distribuito, trasferito, noleggiato, licenziato o trasmesso in pubblico, venduto, prestato a terzi, in tutto o in parte, o utilizzato in alcun altro modo, compreso l'uso per TDM, training dell'intelligenza artificiale e/o tecnologie similari, o altrimenti diffuso, se non previa espressa autorizzazione dell'Editore.

Qualsiasi distribuzione o fruizione non autorizzata del presente testo, così come l'alterazione delle informazioni elettroniche, costituisce una violazione dei diritti dell'Editore e dell'Autore e sarà sanzionata civilmente e penalmente secondo quanto previsto dalla L. 633/1941 e ss.mm.

ISBN 978-88-299-3524-6

Copyright © 2024 by Piccin Nuova Libreria S.p.A., Padova

www.piccin.it

Questo libro è dedicato a tutti gli appassionati e instancabili medici che stanno al letto dei pazienti per fornire loro la migliore assistenza possibile.

Ai miei colleghi, la cui passione per l'ecografia è per me fonte di forza.

Ai miei pazienti, i cui percorsi mi hanno insegnato molto più della medicina.

Alla mia famiglia, il cui sostegno, sacrificio e amore hanno reso tutto questo possibile.

NS

Con gratitudine alla mia famiglia, ai miei mentori e ai miei pazienti.

RA

Ai miei angeli, Amy, Ella, Eve e Violet, e ai miei cari genitori, Leslie e Odile, per la loro incrollabile pazienza, il loro sostegno e il loro amore.

PK



CURATORI DELL'EDIZIONE ITALIANA

Esterita Accogli

Centro Ecografico
Dipartimento Medico
Ospedale Maggiore, Bologna
Sezioni 4, 5, 6, 8, 9

Andrea Domanico

Centro Ecografico
Dipartimento Medico
Ospedale Maggiore, Bologna
Sezioni 4, 5, 6, 8, 9

Luna Gargani

Dipartimento di Patologia Chirurgica, Medica,
Molecolare e dell'Area Critica
Università di Pisa
Sezione 3

Giovanni Volpicelli

Professore Associato di Medicina Interna/
Medicina d'Urgenza
Dipartimento di Scienze Mediche e Chirurgiche
Università degli Studi "Magna Græcia" di
Catanzaro
Sezioni 1, 2, 7, 10

Con la collaborazione di

Matteo Mazzola

Dipartimento di Patologia Chirurgica, Medica,
Molecolare e dell'Area Critica
Università di Pisa
Sezione 3



È stato dimostrato che l'ecografia point-of-care (POCUS) rende le procedure più sicure, accelera e aumenta l'accuratezza delle diagnosi e incrementa la sicurezza nel processo decisionale clinico. La POCUS è una delle poche nuove tecnologie che avvicina l'operatore sanitario direttamente al letto del paziente, migliorando così l'esperienza sia dei pazienti che degli operatori sanitari stessi.

La prima edizione di *Point-of-Care Ultrasound* è stata pubblicata nel 2014 e ha posto le basi per la condivisione delle conoscenze tra diversi ambiti specialistici che utilizzano le più diverse applicazioni ecografiche al letto del paziente. Dalla sua prima pubblicazione, il libro è stato tradotto in cinese e spagnolo, con migliaia di copie distribuite in tutto il mondo. Man mano che gli operatori sanitari imparavano a conoscere le potenzialità della POCUS, un numero crescente di essi ha utilizzato questo libro. Data la natura visiva e dinamica dell'ecografia, questo libro mette a disposizione numerosi video. Il suo stile da manuale, i capitoli concisi, le figure esplicative e i suggerimenti di insegnamento pratici sono accattivanti anche per i medici più impegnati che cercano di ampliare le loro conoscenze in materia di ecografia.

In questa seconda edizione, abbiamo allargato i contenuti in diversi modi. In primo luogo, abbiamo aggiunto sei nuovi capitoli sull'emodinamica, sull'ecocardiografia transesofagea, sul secondo e terzo trimestre di gravidanza, sulla pediatria, sulla neonatologia e sull'ecografia transcranica. In secondo luogo, abbiamo aumentato i contenuti video online da circa 300 a oltre 1000 video che mostrano gli aspetti ecografici normali e patologici. In terzo luogo, abbiamo aggiunto nuovi casi clinici e domande di verifica alla fine di ogni capitolo, sottolineando i punti chiave dell'apprendimento. Infine, ci siamo tenuti al passo con questo campo in rapida evoluzione aggiornando la letteratura, le immagini e le figure in ogni capitolo.

I principi e le ampie applicazioni della POCUS sono trattati in modo dettagliato. Siamo certi che gli operatori sanitari di qualsiasi ambito che desiderino imparare la POCUS saranno soddisfatti da questa seconda edizione del nostro libro.

Nilam J. Soni
Robert Anrtfield
Pierre Kory



Mohammed M. Abbasi, MD

Division of Pulmonary and Critical Care
 Albert Einstein College of Medicine
 Montefiore Medical Center
 Bronx, New York

Sara Ahmadi, MD, ECNU

Assistant Professor of Medicine
 Division of Endocrinology
 Duke University Medical Center
 Durham, North Carolina

Stephen Alerhand, MD

Assistant Professor
 Department of Emergency Medicine
 Rutgers New Jersey Medical School
 Newark, New Jersey

Phillip Andrus, MD, FACEP

Assistant Professor of Emergency Medicine
 Assistant Director of Emergency Ultrasound
 Icahn School of Medicine at Mount Sinai
 New York, New York

Shane Arishenkoff, MD, FRCPC

Assistant Clinical Professor
 Division of General Internal Medicine
 Department of Medicine
 University of British Columbia
 Vancouver, British Columbia, Canada

Robert Arntfield, MD, FRCPC

Associate Professor of Medicine
 Division of Emergency Medicine and Division of
 Critical Care Medicine
 Schulich School of Medicine & Dentistry
 Western University
 London Health Sciences Centre
 London, Ontario, Canada

Uché Blackstock, MD

Assistant Professor
 Co-Director of Emergency Ultrasound Fellowship
 Department of Emergency Medicine
 New York University School of Medicine
 New York University Langone Health
 New York, New York

Michel Boivin, MD

Professor of Medicine
 Division of Pulmonary, Critical Care, and Sleep
 Medicine
 Department of Medicine
 University of New Mexico
 Albuquerque, New Mexico

Brian M. Buchanan, BSc, MD, FRCPC

Assistant Professor of Critical Care Medicine
 Department of Critical Care Medicine
 University of Alberta
 Edmonton, Alberta, Canada

Jose Cardenas-Garcia, MD

Assistant Professor of Medicine
 Director of Interventional Pulmonology
 Division of Pulmonary & Critical Care Medicine
 Department of Medicine
 University of Michigan
 Ann Arbor, Michigan

Anita Cave, MD, FRCPC

Assistant Professor
 Department of Anesthesia and Perioperative
 Medicine
 Schulich School of Medicine & Dentistry
 Western University
 London Health Sciences Centre
 London, Ontario, Canada

Alfred B. Cheng, MD

Assistant Professor of Emergency Medicine
 Director of the Division of Emergency Medicine
 Ultrasound
 Department of Emergency Medicine
 Cooper Medical School of Rowan University
 Camden, New Jersey

Gregg L. Chesney, MD

Assistant Professor of Emergency Medicine
 Department of Emergency Medicine and Division
 of Pulmonary, Critical Care, and Sleep Medicine
 New York University School of Medicine
 New York University Langone Health/Brooklyn
 Medical Center
 New York, New York

Alan T. Chiem, MD, MPH

Associate Clinical Professor
Director of Emergency Ultrasound
Department of Emergency Medicine
University of California Los Angeles
Olive View-UCLA Medical Center
Los Angeles, California

Thomas W. Conlon, MD

Assistant Professor of Pediatrics
Department of Anesthesiology and Critical Care
Medicine
Perelman School of Medicine at the University of
Pennsylvania
Children's Hospital of Philadelphia
Philadelphia, Pennsylvania

Sara Crager, MD

Assistant Clinical Professor
Division of Critical Care
Departments of Anesthesia and Emergency
Medicine
University of California Los Angeles
Los Angeles, California

Ria Dancel, MD, FHM, FAAP, FACP

Associate Professor of Medicine and Pediatrics
Director of Medicine Procedure Service
Division of Hospital Medicine
Departments of Medicine and Pediatrics
University of North Carolina
Chapel Hill, North Carolina

Christopher Dayton, MD

Clinical Assistant Professor
Division of Pulmonary & Critical Care Medicine
Departments of Medicine and Emergency
Medicine
University of Texas Health San Antonio
San Antonio, Texas

Eitan Dickman, MD, MMM, FACEP, FAIUM

Executive Vice Chairman and Medical Director
Department of Emergency Medicine
Maimonides Medical Center
New York, New York

Maili Drachman, MD

Assistant Professor
Department of Emergency Medicine
University of Arizona Health Sciences
Tucson, Arizona

John Eicken, MD, Ed.M.

Clinical Assistant Professor
Division of Emergency Ultrasound
Department of Emergency Medicine
University of South Carolina School of Medicine
Greenville
Greenville Health System
Greenville, South Carolina

Lewis A. Eisen, MD

Professor of Medicine
Division of Critical Care Medicine
Albert Einstein College of Medicine
Montefiore Medical Center
New York, New York

James F. Fair III, MD, FASE, FACEP

Assistant Professor of Emergency Medicine
Division of Emergency Medicine
Department of Surgery
University of Utah Health Sciences Center
Salt Lake City, Utah

Daniel Fein, MD

Assistant Professor of Medicine
Division of Pulmonary Medicine
Department of Medicine
Albert Einstein School of Medicine
Montefiore Medical Center
Bronx, New York

Stephanie Fish, MD

Associate Professor of Medicine
Division of Endocrinology
Department of Medicine
Memorial Sloan Kettering Cancer Center
New York, New York

John Christian Fox, MD

Professor of Emergency Medicine
Interim Chair of the Department of Emergency
Medicine
University of California Irvine
Orange, California

María V. Fraga, MD

Associate Professor of Clinical Pediatrics
Division of Neonatology
Department of Pediatrics
Perelman School of Medicine at the University of
Pennsylvania
Children's Hospital of Philadelphia
Philadelphia, Pennsylvania

Ricardo Franco-Sadud, MD

Associate Professor of Medicine
Director of Academic Hospital Medicine and
Point of Care Ultrasound
University of Central Florida College of Medicine
Naples Community Hospital
Naples, Florida

Kelly S. Gibson, MD

Assistant Professor
Department of Obstetrics/Gynecology-Maternal
Fetal Medicine
Case Western Reserve University School of
Medicine
University Hospitals Cleveland Medical Center
Cleveland, Ohio

Laura K. Gonzalez, MD, FAAP

Attending Physician
Division of Emergency Ultrasound
Department of Emergency Medicine
Maimonides Medical Center
New York, New York

Ben Goodgame, MD, RDMS

Attending Physician
Critical Care Medicine
Centennial Medical Center
Nashville, Tennessee

Behzad Hassani, MD, CCFP (EM)

Assistant Professor
Division of Emergency Medicine
Schulich School of Medicine & Dentistry
Western University
London Health Sciences Centre
London, Ontario, Canada

Ahmed F. Hegazy, MB BCH, MPH, FRCPC

Assistant Professor
Division of Critical Care Medicine
Department of Anesthesia and Perioperative
Medicine
Schulich School of Medicine & Dentistry
Western University
London Health Sciences Centre
London, Ontario, Canada

Patricia C. Henwood, MD

Assistant Professor of Emergency Medicine
Associate Chief of the Division of Emergency
Ultrasound
Department of Emergency Medicine
Harvard Medical School
Brigham and Women's Hospital
Boston, Massachusetts

Hailey Hobbs, MD, FRCPC

Assistant Professor of Medicine
Department of Critical Care
Queen's University
Kingston, Ontario, Canada

J. Terrill Huggins, MD

Professor of Medicine
Division of Pulmonary, Critical Care, Allergy, and
Sleep Medicine
Medical University of South Carolina
Charleston, South Carolina

Sahar Janjua, MBBS

Attending Physician
Division of Rheumatology
Department of Medicine
Frisbie Memorial Hospital
Rochester, New Hampshire

Maykol Postigo Jasahui, MD

Assistant Professor of Medicine
Interventional Pulmonary Medicine
Division of Pulmonary/Critical Care
University of Kansas Medical Center
Kansas City, Kansas

Robert Jones, DO, FACEP

Professor of Emergency Medicine
Director of Emergency Ultrasound
Department of Emergency Medicine
Case Western Reserve Medical School
MetroHealth Medical Center
Cleveland, Ohio

David O. Kessler, MD, MSc, RDMS/APCA

Assistant Professor of Pediatrics
Department of Pediatrics
Columbia University College of Physicians and
Surgeons
New York Presbyterian–Morgan Stanley
Children's Hospital
New York, New York

Chan Kim, MD

Instructor of Rheumatology
Division of Rheumatology
Boston University School of Medicine
Boston, Massachusetts

Jae H. Kim, MD, PhD

Professor of Clinical Pediatrics
Divisions of Neonatology & Pediatric
Gastroenterology, Hepatology and Nutrition
University of California San Diego
Children's Hospital of San Diego
La Jolla, California

Eugene Kissin, MD

Associate Professor of Medicine
Program Director of Rheumatology Fellowship
Division of Rheumatology
Boston University School of Medicine
Boston, Massachusetts

Starr Knight, MD

Associate Clinical Professor of Emergency
Medicine
Co-Director of Emergency Ultrasound Fellowship
Department of Emergency Medicine
University of California San Francisco School of
Medicine
San Francisco, California

Pierre Kory, MD, MPA

Associate Professor of Medicine
Division of Allergy, Pulmonary, and Critical Care
Medicine
University of Wisconsin School of Medicine and
Public Health
Madison, Wisconsin

Daniel Lakoff, MD, FACEP

Assistant Professor of Clinical Emergency
Medicine
Department of Emergency Medicine
Weill Cornell Medical College
New York, New York

Viera Lakticova, MD

Assistant Professor of Medicine
Director of Bronchoscopy and Interventional
Pulmonology
Division of Pulmonary, Critical Care, and Sleep
Medicine
Long Island Jewish Medical Center and North
Shore University Hospital
Donald and Barbara Zucker School of Medicine at
Hofstra/Northwell
Hempstead, New York

Elizabeth Lalonde, MD, FRCP

Department of Emergency Medicine
Centre Hospitalier de l'Université Laval (CHUL)
de Québec
Université Laval
Québec City, Quebec, Canada

Justin R. Lappen, MD

Assistant Professor
Department of Reproductive Biology
Case Western Reserve University School of Medicine
University Hospitals Cleveland Medical Center
Cleveland, Ohio

Vincent I. Lau, MD, FRCPC

Adjunct Professor
Division of Critical Care Medicine
Schulich School of Medicine & Dentistry
Western University
London, Ontario, Canada

Alycia Paige Lee, BS, RDCS, RVT

Liberty University College of Osteopathic
Medicine
Lynchburg, Virginia

Peter M. Lee, MD

Assistant Professor of Medicine
Director of Interventional Pulmonology & Lung
Cancer Screening
Division of Pulmonary & Critical Care
Hunter-Holmes McGuire Veterans Affairs Medical
Center
Virginia Commonwealth University
Richmond, Virginia

W. Robert Leeper, MD, MEd, FRCSC, FACS

Assistant Professor of Surgery
Trauma, and Critical Care Medicine
Division of General Surgery
Department of Surgery
Schulich School of Medicine & Dentistry
Western University
Victoria Hospital
London Health Sciences Centre
London, Ontario, Canada

Shankar LeVine, MD

Department of Emergency Medicine
Alameda Health System
Highland General Hospital
Oakland, California

Ken E. Lyn-Kew, MD

Associate Professor of Medicine
Section Head of Critical Care Medicine
Division of Pulmonary, Critical Care, and Sleep
Medicine
University of Colorado
National Jewish Health
Denver, Colorado

Irene Ma, MD, PhD, FRCPC, FACP, RDMS, RDCS

Associate Professor of Medicine
Division of General Internal Medicine
Cumming School of Medicine
University of Calgary
Calgary, Alberta, Canada

Haney Mallemat, MD, MS

Associate Professor of Emergency and Internal
Medicine
Departments of Emergency Medicine and Critical
Care Medicine
Cooper Medical School at Rowan University
Camden, New Jersey

Daniel Mantuani, MD, MPH

Department of Emergency Medicine
Alameda Health System
Highland General Hospital
Oakland, California

Michael Mayette, MD, FRCPC

Associate Professor of Medicine
Division of Critical Care Medicine
Department of Medicine
Université de Sherbrooke
Sherbrooke, Québec, Canada

Paul Mayo, MD

Professor of Clinical Medicine
Academic Director of Critical Care
Division of Pulmonary, Critical Care, and Sleep
Medicine
Long Island Jewish Medical Center and North
Shore University Hospital
Donald and Barbara Zucker School of Medicine at
Hofstra/Northwell
Hempstead, New York

Paul G. McHardy, MD, FRCPC

Assistant Professor of Anesthesia
Department of Anesthesia
University of Toronto
Sunnybrook Health Sciences Centre
Toronto, Ontario, Canada

Scott Millington, MD, FRCPC

Associate Professor of Medicine
Department of Critical Care Medicine
University of Ottawa and the Ottawa Hospital
Ottawa, Ontario, Canada

Paul K. Mohabir, MD

Clinical Professor of Medicine
Director of Critical Care Medicine Fellowship
Director of Adult Cystic Fibrosis Program
Division of Pulmonary and Critical Care Medicine
Stanford University School of Medicine
Stanford, California

Patrick Murphy, MD, MPH, MSc, FRCSC

Division of General Surgery
Department of Surgery
Schulich School of Medicine and Dentistry
Western University
London, Ontario, Canada

Arun Nagdev, MD

Director of Emergency Ultrasound
Alameda Health System
Highland General Hospital
Oakland, California

Mangala Narasimhan, DO, FCCP

Professor of Clinical Medicine
Regional Director of Critical Care Medicine
Northwell Health
Donald and Barbara Zucker School of Medicine at
Hofstra/Northwell
Hempstead, New York

Bret P. Nelson, MD, FACEP

Professor of Emergency Medicine
Chief of the Division of Emergency Ultrasound
Department of Emergency Medicine
Icahn School of Medicine at Mount Sinai
New York, New York

Vicki E. Noble, MD

Professor of Emergency Medicine
Vice Chairman of Academic Affairs
Program Director of Emergency Medicine
Case Western Reserve School of Medicine
University Hospitals Cleveland Medical Center
Cleveland, Ohio

Paru Patrawalla, MD

Assistant Professor of Medicine
Program Director of Pulmonary/Critical Care
Fellowship
Division of Pulmonary, Critical Care, and Sleep
Medicine
Icahn School of Medicine at Mount Sinai
New York, New York

Daniel R. Peterson, MD, PhD, FRCPC, RDMS

Clinical Assistant Professor
Academic Department of Emergency Medicine
University of Calgary
Foothills Medical Centre
Calgary, Alberta, Canada

Nitin Puri, MD, FCCP

Associate Professor of Medicine
Program Director of Critical Care Medicine
Fellowship
Interim Division Head of Critical Care Medicine
Cooper Medical School of Rowan University
Camden, New Jersey

Xian Qiao, MD

Division of Pulmonary and Critical Care Medicine
Virginia Commonwealth University Health System
Richmond, Virginia

Aviral Roy, MD

Consultant
Critical Care Medicine and Internal Medicine
Medical Institute of Critical Care
Medica Superspecialty Hospital
Kolkata, India

Lewis Satterwhite, MD, FCCP

Associate Professor of Medicine
Division of Pulmonary, Critical Care, and Sleep
Medicine
University of Kansas School of Medicine
Kansas City, Kansas

Daniel J. Schnobrich, MD, FACP

Assistant Professor of Medicine
Divisions of General Internal Medicine and
Hospital Pediatrics
University of Minnesota School of Medicine
Minneapolis, Minnesota

Shideh Shafie, MD

Assistant Professor of Emergency Medicine
Department of Emergency Medicine
Brown University
Providence, Rhode Island

Ariel L. Shiloh, MD

Associate Professor of Medicine and Neurology
Division of Critical Care Medicine
Departments of Medicine and Neurology
Albert Einstein College of Medicine
Montefiore Medical Center
Bronx, New York

Craig Sisson, MD, RDMS

Clinical Associate Professor
Chief of the Division of Emergency Ultrasound
Department of Emergency Medicine
University of Texas Health San Antonio
San Antonio, Texas

Jessica Solis-McCarthy, MD

Assistant Clinical Professor
Assistant Director of Ultrasound Education
Department of Emergency Medicine
University of Texas Health San Antonio
San Antonio, Texas

Nilam J. Soni, MD, MS

Professor of Medicine
Division of General & Hospital Medicine
and Division of Pulmonary & Critical Care
Medicine
University of Texas Health San Antonio
San Antonio, Texas

Kirk T. Spencer, MD, FASE

Professor of Medicine
Section of Cardiology
Department of Medicine
University of Chicago-Pritzker School of Medicine
Chicago, Illinois

Erik Su, MD

Division of Pediatric Cardiology
Department of Pediatrics
Stanford University School of Medicine
Palo Alto, California

Christopher R. Tainter, MD, RDMS

Clinical Associate Professor
Division of Critical Care
Departments of Anesthesiology and Emergency
Medicine
University of California San Diego School of
Medicine
San Diego, California

Nathan Teismann, MD

Associate Clinical Professor
Department of Emergency Medicine
University of California San Francisco School of
Medicine
San Francisco, California

Felipe Teran, MD, MSCE

Clinical Instructor
Division of Emergency Ultrasound and Center for
Resuscitation Science
Department of Emergency Medicine
University of Pennsylvania
Hospital of the University of Pennsylvania
Philadelphia, Pennsylvania

David M. Tierney, MD, FACP

Program Director of Internal Medicine Residency
Department of Medical Education
Abbott Northwestern Hospital
Minneapolis, Minnesota

Matthew D. Tyler, MD, RDMS

Division of Critical Care Medicine
Department of Emergency Medicine
Advocate Christ Medical Center
Oak Lawn, Illinois

Marsia Vermeulen, DO, RDMS, RDCS, FACEP

Assistant Professor of Emergency Medicine
Department of Emergency Medicine
New York University School of Medicine
New York University Langone Health/Bellevue
Hospital Center
New York, New York

Stephen D. Walsh, MD, FRCPC

Departments of Critical Care Medicine and
General Internal Medicine
Dalhousie University
Halifax, Nova Scotia, Canada

Gabriel Wardi, MD, MPH

Clinical Assistant Professor
Division of Pulmonary, Critical Care, and Sleep
Medicine
Department of Emergency Medicine
University of California San Diego School of
Medicine
San Diego, California

Michael Y. Woo, MD

Associate Professor
Program Director of Emergency Medicine
Ultrasound Fellowship
Department of Emergency Medicine
University of Ottawa and Ottawa Hospital
Research Institute
Ottawa, Ontario, Canada

Gulrukh Zaidi, MD, FCCP

Assistant Professor of Medicine
Division of Pulmonary, Critical Care and Sleep
Medicine
Long Island Jewish Medical Center and North
Shore University Hospital
Donald and Barbara Zucker School of Medicine at
Hofstra/Northwell
Hempstead, New York



Hanno contribuito alle immagini ecografiche:

Atul Jaidka, MD (Lead Contributor)

Department of Medicine
Western University
London Health Sciences Centre
London, Ontario, Canada

Jeremy Boyd, MD

Assistant Professor
Department of Emergency Medicine
Vanderbilt University
Nashville, Tennessee

Arben Brahaj, MD, RMSK

Assistant Clinical Professor
Department of Orthopedics and Rehabilitation
Yale School of Medicine
VA Connecticut Healthcare System
West Haven, Connecticut

John P. Corcoran, BM BCh, MRCP

Oxford Centre for Respiratory Medicine
Oxford University Hospitals NHS Trust
Oxford, United Kingdom

Janeve Desy, MD, FRCPC

Assistant Professor
Division of General Internal Medicine
University of Calgary
Calgary, Alberta, Canada

Danny Duque, MD, RDMS, FACEP

Assistant Professor
Department of Emergency Medicine
Elmhurst Hospital Center
New York, New York

Laleh Gharahbaghian, MD

Clinical Associate Professor
Department of Emergency Medicine
Stanford University Medical Center
Stanford, California

Horiana Grosu, MD

Assistant Professor
Department of Pulmonary Medicine
The University of Texas MD Anderson Cancer
Center
Houston, Texas

Jennifer Huang, DO, FACEP

Assistant Professor
Department of Emergency Medicine
Icahn School of Medicine at Mount Sinai
New York, New York

Christian B. Laursen, MD, PhD

Associate Professor
Institute of Clinical Research
University of Southern Denmark
Odense, Denmark

Alycia Paige Lee, BS, RDCS, RVT

Liberty University College of Osteopathic
Medicine
Lynchburg, Virginia

Roya Etemad Rezaei, MD, FRCPC

Associate Professor
Department of Diagnostic Radiology and Nuclear
Medicine
Western University
London Health Sciences Centre
London, Ontario, Canada

Rebecca Riggs, MD

Assistant Professor
Department of Pediatric Anesthesiology and
Critical Care Medicine
Johns Hopkins University
Baltimore, Maryland

Christopher Schott, MD, MS

Assistant Professor
Department of Critical Care Medicine
University of Pittsburgh
Pittsburgh, Pennsylvania

Allen Shefrin, MD, FRCPC

Assistant Professor
Department of Pediatrics
University of Ottawa
Children's Hospital of Eastern Ontario
Ottawa, Ontario, Canada

Jason Stoller, MD

Associate Professor
Division of Neonatology
Perelman School of Medicine at the University of
Pennsylvania Medical School
Philadelphia, Pennsylvania

Ee Tay, MD, FAAP

Assistant Professor
Department of Emergency Medicine and
Pediatrics
Icahn School of Medicine at Mount Sinai
New York, New York

Drew Thompson, MD, FRCPC

Associate Professor
Department of Emergency Medicine
Western University
London Health Sciences Centre
London, Ontario, Canada

Brita E. Zaia, MD, FACEP

Director, Emergency Ultrasound
Department of Emergency Medicine
Kaiser San Francisco Medical Center
San Francisco, California

Hanno contribuito come revisori:

Jason Filopei, MD

Assistant Professor of Medicine
Division of Pulmonary, Critical Care, and Sleep
Medicine
Department of Medicine
Icahn School of Medicine at Mount Sinai
New York, New York

Elizabeth K. Haro, MPH

Division of Pulmonary & Critical Care Medicine
Department of Medicine
University of Texas Health San Antonio
San Antonio, Texas

Robert Nathanson, MD, FACP

Assistant Professor
Division of General & Hospital Medicine
Department of Medicine
University of Texas Health San Antonio
New York, New York

Kevin Proud, MD, FCCP

Assistant Professor of Medicine
Division of Pulmonary Diseases & Critical Care
Medicine
Department of Medicine
University of Texas Health San Antonio
San Antonio, Texas

Katie Wiskar, MD, FRCPC

Division of General Internal Medicine
Department of Medicine
University of British Columbia
Vancouver, British Columbia, Canada

Per illustrazioni originali e fotografie:

Victoria Heim, CMI

Medical Illustrator
Loganville, Georgia

Jordan Hill, BA

Health and Fitness Consultant
P&G Professional
San Antonio, Texas

Jade Myers

Graphic Designer
Matrix Art Services
York, Pennsylvania

Sam Newman

3D Medical Animator
University of Texas Health San Antonio
San Antonio, Texas

Lester Rosebrock

Photographer
Lester Multimedia
San Antonio, Texas

Ringraziamo il nostro mentore:

Paul H. Mayo, MD

Professor of Clinical Medicine
Academic Director of Critical Care
Division of Pulmonary, Critical Care, and Sleep
Medicine
Long Island Jewish Medical Center and North
Shore University Hospital
Donald and Barbara Zucker School of Medicine at
Hofstra/Northwell
Hempstead, New York

SEZIONE 1 **Principi fondamentali di ecografia**

- 1 **Evoluzione della ecografia Point-of-Care** 1
Nilam J. Soni ■ Robert Arntfield ■ Pierre Kory
- 2 **Fisica degli ultrasuoni e modalità di visualizzazione** 9
Michael Mayette ■ Paul K. Mohabir
- 3 **Sonde** 27
Alan T. Chiem
- 4 **Orientamento** 37
Sara Crager ■ Paul K. Mohabir
- 5 **Operazioni base per un ecografo** 46
Michel Boivin
- 6 **Immagini artefattuali** 56
Alfred B. Cheng ■ Alycia Paige Lee ■ Ben Goodgame ■ Nitin Puri

SEZIONE 2 **Polmoni e pleura**

- 7 **Descrizione generale** 65
Ken E. Lyn-Kew
- 8 **Tecniche di ecografia polmonare e pleurica** 70
Daniel Fein ■ Mohammed M. Abbasi
- 9 **Interpretazione dell'ecografia polmonare** 82
Irene Ma ■ Vicki E. Noble
- 10 **Pleura e diaframma** 100
Ria Dancel ■ Xian Qiao ■ Peter M. Lee
- 11 **Procedure polmonari e pleuriche** 114
Jose Cardenas-Garcia ■ J. Terrill Huggins
- 12 **Dispnea ed embolia polmonare** 128
Christopher Dayton ■ Lewis A. Eisen

SEZIONE 3 **Cuore**

- 13 **Panoramica (overview)** 141
Kirk T. Spencer
- 14 **Basi tecniche dell'ecocardiografia** 151
Scott Millington
- 15 **Funzione ventricolare sinistra** 169
Robert Arntfield ■ Stephen D. Walsh ■ Pierre Kory ■ Nilam J. Soni
- 16 **Funzione ventricolare destra** 183
James F. Fair III ■ Robert Arntfield
- 17 **Vena cava inferiore** 202
Matthew D. Tyler ■ Robert Arntfield ■ Aviral Roy ■ Haney Mallema

- 18 **Versamento pericardico** 222
Shane Arishenkoff ■ Maili Drachman ■ John Christian Fox
- 19 **Valvole** 241
Ahmed F. Hegazy
- 20 **Ecocardiografia transesofagea** 255
Brian M. Buchanan ■ Hailey Hobbs ■ Robert Arntfield
- 21 **Emodinamica** 274
Gulrukh Zaidi ■ Vincent I. Lau ■ Paul Mayo
- 22 **Ipotensione e shock** 291
Mangala Narasimhan ■ Viera Lakticova
- 23 **Arresto cardiaco** 307
Phillip Andrus ■ Felipe Teran

SEZIONE 4 **Addome e pelvi**

- 24 **Versamento libero addominale** 319
Craig Sisson ■ Jessica Solis-McCarthy
- 25 **Reni** 334
Behzad Hassani
- 26 **Vescica** 349
Behzad Hassani
- 27 **Colecisti** 359
Daniel R. Peterson
- 28 **Aorta addominale** 373
Christopher R. Tainter ■ Gabriel Wardi
- 29 **Primo trimestre di gravidanza** 384
Starr Knight ■ Nathan Teismann
- 30 **Secondo e terzo trimestre di gravidanza** 408
Justin R. Lappen ■ Kelly S. Gibson ■ Robert Jones
- 31 **L'ecografia testicolare** 428
Daniel Lakoff ■ Stephen Alerhand
- 32 **Il dolore addominale** 443
John Eicken ■ Patricia C. Henwood
- 33 **L'ecografia del trauma** 451
Patrick Murphy ■ W. Robert Leeper

SEZIONE 5 **Sistema vascolare**

- 34 **Trombosi venosa profonda degli arti inferiori** 466
Ariel L. Shiloh
- 35 **Trombosi venosa profonda degli arti superiori** 476
Lewis Satterwhite ■ Maykol Postigo Jasahui
- 36 **Accesso venoso centrale** 490
Ricardo Franco-Sadud ■ Nilam J. Soni
- 37 **Accesso venoso periferico** 502
Felipe Teran ■ Bret P. Nelson

- 38 **Accesso arterioso** 510
Anita Cave

SEZIONE 6 **Testa e collo**

- 39 **Ecografia oculare** 520
Gregg L. Chesney ■ Marsia Vermeulen
- 40 **La ghiandola tiroidea** 536
Sara Ahmadi ■ Stephanie Fish
- 41 **Linfonodi** 553
Ricardo Franco-Sadud

SEZIONE 7 **Sistema nervoso**

- 42 **Blocchi nervosi periferici** 563
Arun Nagdev ■ Shankar LeVine ■ Daniel Mantuani
- 43 **Puntura lombare** 582
Paul G. McHardy ■ Daniel J. Schnobrich ■ David M. Tierney ■ Nilam J. Soni
- 44 **Ecografia transcranica** 594
Vincent I. Lau ■ Robert Arntfield

SEZIONE 8 **Tessuti molli e articolazioni**

- 45 **Cute e tessuti molli** 604
Michael Y. Woo ■ Elizabeth Lalande
- 46 **Articolazioni** 620
Sahar Janjua ■ Chan Kim ■ Eugene Kissin

SEZIONE 9 **Pediatria**

- 47 **Pediatria** 660
Thomas W. Conlon ■ David O. Kessler ■ Erik Su
- 48 **Neonatologia** 683
María V. Fraga ■ Thomas W. Conlon ■ Jae H. Kim ■ Erik Su

SEZIONE 10 **Gestione del programma ultrasuoni**

- 49 **Competenze, credenziali, e certificazioni** 706
Paru Patrawalla ■ Uché Blackstock
- 50 **Equipaggiamento, flusso di lavoro, fatturazione** 715
Laura K. Gonzalez ■ Shideh Shafie ■ Eitan Dickman
- Indice analitico** 725

