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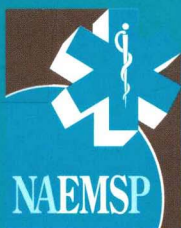
# EMERGENCY MEDICAL SERVICES

CLINICAL PRACTICE AND  
SYSTEMS OVERSIGHT

VOLUME 2: MEDICAL OVERSIGHT OF EMS

Editor-in-Chief  
**David C. Cone**

Editors  
**Jane H. Brice**  
**Theodore R. Delbridge**  
**J. Brent Myers**



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# Emergency Medical Services

## Clinical Practice and Systems Oversight

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**Volume 2: Medical Oversight of EMS**

### **Second Edition**

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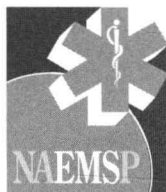
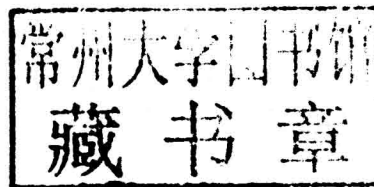
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*Library of Congress Cataloging-in-Publication Data*

Emergency medical services (Cone)

Emergency medical services : clinical practice and systems oversight / edited by David C. Cone, Jane H. Brice, Theodore R. Delbridge, J. Brent Myers. – Second edition.  
p. : cm.

Includes bibliographical references and index.

ISBN 978-1-118-86530-9 (pbk.)

I. Cone, David C., editor. II. Brice, Jane H., editor. III. Delbridge, Theodore R., editor. IV. Myers, J. Brent, editor. V. Title.

[DNLM: 1. Emergency Medical Services. 2. Emergency Medicine. WX 215]

RA645.5

362.18--dc23

2014039737

A catalogue record for this book is available from the British Library.

Set in 9.5/12pt Minion pro by SPi Publisher Services, Pondicherry, India

Printed in Singapore by C.O.S. Printers Pte Ltd

1 2015

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# Foreword

As this book is published, the National Association of EMS Physicians® has finished celebrating its 30th anniversary. This is a great sign that the association is maturing. This is our fifth edition of the textbook, and the previous editions have served as a key resource for EMS medical directors, fellowship directors, and managers. The association has grown in size, has an established and well-attended annual meeting, and serves as a key resource for the EMS community as a whole. As always, we remain focused on patient outcomes and providing the best possible patient care.

In other ways, this is just the beginning. This is the first edition of the textbook published since EMS has become a recognized medical subspecialty. This fact alone makes this

book a landmark edition. Within its pages, the reader will find the definitive reference for the core content in EMS. This book will serve as the foundation for our young specialty. The editors and authors who contributed to this work understand the key role this book plays in preparing our new subspecialists.

I want to thank Drs Cone, Brice, Delbridge, and Myers for their hard work as editors of this text. It is their passion for and incredible contributions to our specialty that made them the perfect choice for leading this endeavor.

Ritu Sahni, MD, MPH  
President, National Association  
of EMS Physicians®

# Preface

Since the earliest versions of this textbook in 1989, the subspecialty of EMS has evolved dramatically. In addition to increasing sophistication and application of expertise, EMS has developed to encompass a unique body of knowledge. Recognizing these features and an ongoing need to nurture the professionalism of those who are and might become committed to EMS, the American Board of Medical Specialties recognized EMS as a subspecialty in 2010. The American Board of Emergency Medicine administered the first certification examination in 2013, leading to the very first board-certified EMS subspecialists. The Accreditation Council for Graduate Medical Education has accredited 41 EMS fellowship programs as of this writing.

This second edition of *Emergency Medical Services: Clinical Practice and Systems Oversight* builds on the foundations of its predecessors, *EMS Medical Directors Handbook* (1989), *Prehospital Systems and Medical Oversight* (1994, 2002), and the first edition of this book in 2009. At the same time, planning this to be the primary textbook for those EMS fellowship programs, it is intended to be more concise and focused, reducing redundancy and making it an ideal source for reliable information. Within its pages is the core content thought to be relevant to EMS fellows and that which forms the basis for the certification examination. The Appendix shows this core content, previously published by the American Board of Emergency Medicine [1].

We are, of course, proud of this textbook's authors. They were careful to ensure that the right information is included in their

topic areas, meaning reliable and appropriately comprehensive. However, we are also indebted and most grateful to the authors and editors of the prior books noted above. They have served our subspecialty well by creating a foundation upon which we have been able to build a solid structure of unique knowledge, academic integrity, and clinical expertise. We share with the authors of this edition a sense of deep gratitude and sincere appreciation for the contributions made by authors of previous editions of this text. In many cases, their knowledge has been retained in this edition while in others their frameworks and underpinnings were used by the current authors as they updated content to reflect current best practices. To all who have contributed to this textbook, to all who contributed to prior versions, to all who commit parts of their professional lives to improving the delivery of EMS, and to all who will glean for themselves new knowledge through this textbook, we thank you!

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J. Brice  
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B. Myers

## Reference

- 1 EMS Examination Task Force, American Board of Emergency Medicine. The core content of emergency medical services medicine. *Prehosp Emerg Care* 2012;16(3):309–22.

# Abbreviations

<b>AAOS</b>	American Academy of Orthopedic Surgeons	<b>CISD</b>	critical incident stress debriefing
<b>AAP</b>	American Academy of Pediatrics	<b>CISM</b>	critical incident stress management
<b>ABEM</b>	American Board of Emergency Medicine	<b>CKD</b>	chronic kidney disease
<b>AC</b>	assist control/acromioclavicular	<b>CLIA</b>	Clinical Laboratory Improvement Amendments
<b>ACEP</b>	American College of Emergency Physicians	<b>CNS</b>	central nervous system
<b>ACF</b>	alternative care facility	<b>CO</b>	carbon monoxide
<b>ACLS</b>	Advanced Cardiac Life Support	<b>COPD</b>	chronic obstructive pulmonary disease
<b>ACPE</b>	acute cardiogenic pulmonary edema	<b>CPAP</b>	continuous positive airway pressure
<b>ACS</b>	American College of Surgeons/acute coronary syndrome	<b>CPP</b>	coronary/cerebral perfusion pressure
<b>ADHF</b>	acute decompensated heart failure	<b>CPR</b>	cardiopulmonary resuscitation
<b>AED</b>	automated external defibrillator	<b>CSF</b>	cerebrospinal fluid
<b>AEMS</b>	Advocates for EMS	<b>CSM</b>	confined space medicine
<b>AEMT</b>	advanced emergency medical technician	<b>CT</b>	computed tomography
<b>AGE</b>	arterial gas embolism	<b>DCS</b>	decompression sickness
<b>AHA</b>	American Heart Association	<b>DFI</b>	drug-facilitated intubation
<b>AICD</b>	automatic implantable cardioverter defibrillator	<b>DFSA</b>	drug-facilitated sexual assault
<b>AIS</b>	abbreviated injury scale	<b>DHEW</b>	Department of Health, Education, and Welfare
<b>AKI</b>	acute kidney injury	<b>DHHS</b>	Department of Health and Human Services
<b>ALOC</b>	altered level of consciousness	<b>DHS</b>	Department of Homeland Security
<b>ALS</b>	Advanced Life Support	<b>DKA</b>	diabetic ketoacidosis
<b>ALTE</b>	apparent life-threatening event	<b>DLS</b>	dispatch life support
<b>AMI</b>	acute myocardial infarction	<b>DMAT</b>	Disaster Medical Assistance Team
<b>AMS</b>	altered mental status/acute mountain sickness/air medical services	<b>DMORT</b>	disaster mortuary response team
<b>ANOVA</b>	analysis of variance	<b>DNR</b>	do not resuscitate
<b>ARC</b>	American Red Cross	<b>DOT</b>	Department of Transportation
<b>ASA</b>	American Society of Anesthesiologists/American Stroke Association	<b>DSMB</b>	data and safety monitoring board
<b>ASPR</b>	Assistant Secretary of Preparedness and Response	<b>DVT</b>	deep vein thrombosis
<b>ASTM</b>	American Society for Testing and Materials	<b>EAP</b>	employee assistance program
<b>ATA</b>	atmosphere absolute	<b>ECG</b>	electrocardiogram
<b>atm</b>	atmosphere	<b>ECLS</b>	extracorporeal life support
<b>AWLS</b>	Advanced Wilderness Life Support	<b>ECMO</b>	extracorporeal membrane oxygenation
<b>BAC</b>	blood alcohol concentration	<b>ED</b>	emergency department
<b>BBP</b>	blood-borne pathogen	<b>EEG</b>	electroencephalogram
<b>BiPAP</b>	bilevel positive airway pressure	<b>eGFR</b>	estimated glomerular filtration rate
<b>BIVAD</b>	biventricular assist device	<b>EMA</b>	emergency management agency
<b>BLS</b>	Basic Life Support	<b>EMAC</b>	Emergency Management Assistance Compact
<b>BMI</b>	body mass index	<b>EMD</b>	emergency medical dispatch
<b>BNP</b>	B-type natriuretic peptide	<b>EMR</b>	emergency medical responder
<b>BSA</b>	body surface area	<b>EMSC</b>	Emergency Medical Services for Children
<b>BVM</b>	bag-valve-mask	<b>EMT</b>	emergency medical technician
<b>CAD</b>	coronary artery disease/computer-aided dispatch	<b>EMT-A</b>	emergency medical technician- ambulance
<b>CAMTS</b>	Commission on Accreditation of Medical Transport Systems	<b>EMTALA</b>	Emergency Medical Treatment and Active Labor Act
<b>CDC</b>	Centers for Disease Control and Prevention	<b>EMT-I</b>	emergency medical technician-intermediate
<b>CDE</b>	continuing dispatch education	<b>EOC</b>	emergency operations center
<b>CERT</b>	community emergency response team	<b>EPA</b>	Environmental Protection Agency
<b>CHF</b>	congestive heart failure	<b>ESAR-VHP</b>	Emergency System for Advanced Registration of Volunteer Health Professionals
<b>CI</b>	confidence interval	<b>ESC</b>	European Society of Cardiology
		<b>ESF</b>	emergency support function

<b>ESRD</b>	end-stage renal disease	<b>KPI</b>	key performance indicator
<b>ETC</b>	esophageal tracheal Combitube	<b>LEOC</b>	local emergency operations center
<b>EtCO<sub>2</sub></b>	end-tidal carbon dioxide	<b>LLD</b>	left lateral decubitus
<b>ETI</b>	endotracheal intubation	<b>LMA</b>	laryngeal mask airway
<b>fast</b>	focused assessment with sonography in trauma	<b>LVAD</b>	left ventricular assist device
<b>FCC</b>	Federal Communications Commission	<b>LZ</b>	landing zone
<b>FCS</b>	Fireground Command System	<b>MAP</b>	mean arterial pressure
<b>FDA</b>	Food and Drug Administration	<b>MCHB</b>	Maternal and Child Health Bureau
<b>FEMA</b>	Federal Emergency Management Agency	<b>MCI</b>	mass casualty incident
<b>FFP</b>	fresh frozen plasma	<b>MDI</b>	metered dose inhaler
<b>ffw</b>	feet of freshwater	<b>MI</b>	myocardial infarction
<b>FICEMS</b>	Federal Interagency Committee on EMS	<b>MOI</b>	mechanism of injury
<b>fsw</b>	feet of seawater	<b>MRC</b>	Medical Reserve Corps
<b>GABA</b>	gamma-aminobutyric acid	<b>MRSA</b>	methicillin-resistant <i>Staphylococcus aureus</i>
<b>GCS</b>	Glasgow Coma Scale	<b>MSDS</b>	Material Safety Data Sheet
<b>GI</b>	gastrointestinal	<b>MTA</b>	medical threat assessment
<b>HACE</b>	high altitude cerebral edema	<b>MUCC</b>	Model Uniform Core Criteria
<b>HAPE</b>	high altitude pulmonary edema	<b>MVC</b>	motor vehicle collision
<b>HBIG</b>	hepatitis B immune globulin	<b>NAEMSP</b>	National Association of EMS Physicians
<b>HBO</b>	hyperbaric oxygen	<b>NAEMT</b>	National Association of EMTs
<b>HBV</b>	hepatitis B virus	<b>NAEMSD</b>	National Association of State EMS Directors
<b>HCFA</b>	Health Care Financing Administration	<b>NAEMSO</b>	National Association of State EMS Officials
<b>HCP</b>	health care provider	<b>NAS-NRC</b>	National Academy of Sciences National Research Council
<b>HCV</b>	hepatitis C virus	<b>NCT</b>	narrow-complex tachydysrhythmia
<b>HEMS</b>	helicopter EMS	<b>NDMS</b>	National Disaster Medical System
<b>HF</b>	hydrofluoric acid	<b>NEDARC</b>	National EMSC Data Analysis Resource Center
<b>HIPAA</b>	Health Insurance Portability and Accountability Act	<b>NEMSIS</b>	National EMS Information System
<b>HIV</b>	human immunodeficiency virus	<b>NFDD</b>	noise/flash diversionary device
<b>HRSA</b>	Health Resources and Services Administration	<b>NFPA</b>	National Fire Protection Association
<b>HSP</b>	Henoch-Schönlein purpura	<b>NGO</b>	non-governmental organization
<b>IABP</b>	intraaortic balloon pump	<b>NHTSA</b>	National Highway Traffic Safety Administration
<b>IAP</b>	incident action plan	<b>NICU</b>	neonatal intensive care unit
<b>IBW</b>	ideal body weight	<b>NIH</b>	National Institutes of Health
<b>IC</b>	incident commander	<b>NIMS</b>	National Incident Management System
<b>ICD</b>	implanted cardioverter-defibrillator	<b>NIOSH</b>	National Institute for Occupational Safety and Health
<b>ICH</b>	intracranial hemorrhage	<b>NIPPV</b>	non-invasive positive pressure ventilation
<b>ICP</b>	intracranial pressure	<b>NKHS</b>	non-ketotic hyperosmolar state
<b>ICS</b>	incident command system	<b>NMDA</b>	n-methyl-D-aspartate
<b>ICU</b>	intensive care unit	<b>NMRT</b>	national medical response team
<b>IDLH</b>	immediately dangerous to life and health	<b>NNT</b>	number needed to treat
<b>I/E</b>	inspiratory-to-expiratory	<b>NREMT</b>	National Registry of Emergency Medical Technicians
<b>IED</b>	improvised explosive device	<b>NSAID</b>	non-steroidal antiinflammatory drug
<b>IJ</b>	internal jugular	<b>NSTEMI</b>	non-ST-elevation MI
<b>IL</b>	interleukin	<b>NVG</b>	night vision goggles
<b>IM</b>	intramuscular	<b>NVRT</b>	National Veterinary Response Team
<b>IMS</b>	incident management system	<b>OHCA</b>	out-of-hospital cardiac arrest
<b>IMSURT</b>	international medical/surgical response team	<b>OR</b>	operating room/odds ratio
<b>IN</b>	intranasal	<b>OSHA</b>	Occupational Safety and Health Administration
<b>IO</b>	intraosseous	<b>PAD</b>	public access defibrillation
<b>IOM</b>	Institute of Medicine	<b>PAI</b>	prearrival instructions
<b>IPE</b>	immersion pulmonary edema	<b>PALS</b>	Pediatric Advanced Life Support
<b>IPV</b>	intimate partner violence	<b>PASG</b>	pneumatic antishock garment
<b>IRB</b>	institutional review board	<b>PAT</b>	Pediatric Assessment Triangle
<b>ISS</b>	injury severity score	<b>PCI</b>	percutaneous coronary intervention
<b>ITD</b>	impedance threshold device	<b>PCR</b>	patient care report
<b>IV</b>	intravenous	<b>PD</b>	peritoneal dialysis
<b>JTTR</b>	Joint Theater Trauma Registry	<b>PDI</b>	postdispatch instruction
<b>JVD</b>	jugular venous distension	<b>PDSA</b>	Plan-Do-Study-Act
<b>KED</b>	Kendrick Extrication Device		

<b>PE</b>	pulmonary embolus	<b>SSC</b>	secondary stroke center
<b>PEA</b>	pulseless electrical activity	<b>SSM</b>	system status management
<b>PEEP</b>	positive end-expiratory pressure	<b>STEMI</b>	ST-segment elevation myocardial infarction
<b>PEL</b>	permissible exposure limit	<b>SVR</b>	systemic vascular resistance
<b>PEP</b>	postexposure prophylaxis	<b>SVT</b>	supraventricular tachycardia
<b>PFAST</b>	prehospital FAST	<b>SWAT</b>	special weapons and tactics
<b>PI</b>	performance improvement	<b>TAC</b>	Technical Assistance Center
<b>PID</b>	pelvic inflammatory disease	<b>TB</b>	tuberculosis
<b>PIO</b>	public information officer	<b>TBI</b>	traumatic brain injury
<b>PIP</b>	peak inspiratory pressure	<b>TBSA</b>	total body surface area
<b>PMCS</b>	perimortem cesarean section	<b>TBW</b>	total body weight
<b>POC</b>	point of care	<b>TCCC</b>	tactical combat casualty care
<b>POLST</b>	Physician Orders for Life-Sustaining Treatment	<b>TdP</b>	torsades de pointes
<b>PPE</b>	personal protective equipment	<b>TECC</b>	Tactical Emergency Casualty Care
<b>PRA</b>	patient reception area	<b>TEMS</b>	tactical emergency medical support
<b>PS</b>	pressure support	<b>TIA</b>	transient ischemic attack
<b>PSC</b>	primary stroke center	<b>TM</b>	tympanic membrane
<b>PSO</b>	patient safety organization	<b>TOA</b>	tuboovarian abscess
<b>PTSD</b>	posttraumatic stress disorder	<b>TOR</b>	termination of resuscitation
<b>PVC</b>	premature ventricular contraction	<b>t-PA</b>	tissue plasminogen activator
<b>QA</b>	quality assurance	<b>TQM</b>	total quality management
<b>QALY</b>	quality-adjusted life-year	<b>TTJV</b>	transtracheal jet ventilation
<b>QI</b>	quality improvement	<b>TV</b>	tidal volume
<b>QM</b>	quality management	<b>TXA</b>	tranexamic acid
<b>RCT</b>	randomized controlled trial	<b>US&amp;R</b>	urban search and rescue
<b>REBOA</b>	reverse endovascular balloon occlusion of the aorta	<b>UTI</b>	urinary tract infection
<b>ROSC</b>	return of spontaneous circulation	<b>UXO</b>	unexploded ordnance
<b>RR</b>	respiratory rate	<b>VAD</b>	ventricular assist device
<b>RSA</b>	rapid sequence airway	<b>VF</b>	ventricular fibrillation
<b>RSI</b>	rapid sequence intubation	<b>VL</b>	video laryngoscope
<b>RSV</b>	respiratory syncytial virus	<b>VNS</b>	vagus nerve stimulator
<b>RTS</b>	Revised Trauma Score	<b>VOAD</b>	Voluntary Organizations Active in Disaster
<b>RVAD</b>	right ventricular assist device	<b>VoIP</b>	voice over internet protocol
<b>SABA</b>	short-acting inhaled beta <sub>2</sub> -agonist	<b>VP</b>	ventriculoperitoneal
<b>SAEM</b>	Society for Academic Emergency Medicine	<b>VT</b>	ventricular tachycardia
<b>SAR</b>	search and rescue	<b>VTE</b>	venous thromboembolism
<b>SARS</b>	severe acute respiratory syndrome	<b>VZV</b>	varicella zoster virus
<b>SBP</b>	systolic blood pressure	<b>WCT</b>	wide-complex tachydysrhythmia
<b>SC</b>	sternoclavicular	<b>WEMS</b>	wilderness EMS
<b>SCA</b>	sudden cardiac arrest	<b>WEMT</b>	wilderness EMT
<b>SCBA</b>	self-contained breathing apparatus	<b>WFA</b>	wilderness first aid
<b>SGA</b>	supraglottic airway	<b>WFR</b>	wilderness first responder
<b>SIMV</b>	synchronized intermittent mandatory ventilation	<b>WHO</b>	World Health Organization
<b>SMS</b>	Simplified Motor Scale/safety management system	<b>WMD</b>	weapon of mass destruction
<b>SOG</b>	standard operating guideline	<b>WMS</b>	Wilderness Medical Society
<b>SRR</b>	survival risk ratio	<b>WPHEC</b>	wilderness prehospital emergency care

# About the companion website

This series is accompanied by a companion website:

**[www.wiley.com/go/cone/naemsp](http://www.wiley.com/go/cone/naemsp)**

The website includes:

- video clips
- interactive MCQs
- link to the EMS Examination Task Force, American Board of Emergency Medicine.



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## SECTION I

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# System Infrastructure