



# Emergency War Surgery



Previous page:

Hero's Highway shuts down. Airmen from the 332nd Expeditionary Medical Group carry a stretcher under the Hero's Highway flag during an aeromedical evacuation training exercise. The historical flag was recently cased in a ceremony on September 1, 2011.

Photograph: US Air Force photo no. 110707-F-GU448-007.

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# Emergency War Surgery

FOURTH UNITED STATES REVISION

2013

*Borden Institute  
US Army Medical Department Center and School  
Fort Sam Houston, Texas*

*Office of The Surgeon General  
United States Army  
Falls Church, Virginia*



“All the circumstances of war surgery thus do violence to civilian concepts of traumatic surgery. The equality of organizational and professional management is the first basic difference. The second is the time lag introduced by the military necessity of evacuation. The third is the necessity for constant movement of the wounded man, and the fourth—treatment by a number of different surgeons at different places instead of by a single surgeon in one place—is inherent in the third. These are all undesirable factors, and on the surface they seem to militate against good surgical care. Indeed, when the overall circumstances of warfare are added to them, they appear to make more ideal surgical treatment impossible. Yet this was not true in the war we have just finished fighting, nor need it ever be true. Short cuts and measures of expediency are frequently necessary in military surgery, but compromises with surgical adequacy are not.”

—*Michael E. DeBakey, MD*  
*Presented at Massachusetts General Hospital*  
*Boston, October 1946*

THE FOURTH UNITED STATES REVISION

of

*EMERGENCY WAR SURGERY*

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## Foreword

It is an honor for me to acknowledge the time, efforts, and experience collected in this fourth revision of *Emergency War Surgery*. Once again, a team of volunteers representing the Military Health System and numerous clinical specialties has committed itself to compiling state-of-the-art principles and practices of forward trauma surgery.

War surgery and treatment of combat casualties at far-forward locations, frequently under austere conditions, continue to save lives. Military medical personnel provide outstanding health support to those who serve in harm's way. As war has evolved, so has our medical support to those who fight. Today, American service members face a new terrain of mobile urban conflict. Despite advances in personal and force protection, our forces remain vulnerable to blast wounds, burns, and multiple penetrating injuries not usually encountered in civilian settings. This publication expertly addresses the appropriate medical management of these and other battle and nonbattle injuries.

I congratulate contributors to this edition for drawing on the experiences of colleagues who recently returned from tours of duty in Southwest Asia to provide the most current handbook. I wish to publicly extend my gratitude, and that of the American people, to the courageous men and women who serve in the medical departments of our armed services. I commend your dedicated service and acknowledge your sacrifices, and those of your families, to provide the best healthcare to those who protect our nation. All Americans are indebted to your service.

Jonathan Woodson, MD  
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May 2012  
Washington, DC



## Preface

The moral test of a nation's character is how its citizens care for those who are ill or injured as a consequence of war. This edition of the *Emergency War Surgery* manual (the 4th revision) exemplifies the continuing commitment of military healthcare providers to Soldier well-being across the continuum of care from remote battlefields to stateside evacuation. This resource epitomizes shared knowledge from healthcare providers dedicated to the delivery of lifesaving care, which underpins our honored legacy of military medicine. The authors have documented our providers' intellectual commitment and unwavering ability to advance the practice of medicine under arduous combat conditions. The battlefield experience has always informed medicine. The increased experience of combat and innovation resulting from the last decade of war will forever be etched within the pages of this manual, not as a monument for posterity, but as a practical handbook to enhance the working medical knowledge and skills of our fighting force.

It is said that the Greek god of medicine, Asclepius, was born as a result of an emergency medical intervention. Heroic acts of courage by Soldiers, Sailors, Airmen, and Marines are a testament to our nation's ability to overcome adversity even in the face of mortal challenge. As enemy tactics in Iraq and Afghanistan evolved, with increased application of improvised and vehicle-borne explosive devices, medical leaders at all levels questioned existing paradigms and conventional wisdom. They developed evidence-based Clinical Practice Guidelines, changed or augmented existing treatment modalities, and spearheaded progressive alterations to ballistic survival gear. From the application of tourniquets at the point of injury to the design and development of prosthetics during the rehabilitative phase of treatment, our medical teams continue to conduct new research and challenge medical dogma to solve current problems.

*Emergency War Surgery* is a testament to the courage exhibited by our military men and women in these difficult times. This manual represents the collective efforts of numerous military scholars and

pays homage to those who willingly paid the ultimate price of freedom. Each word should be read in their honor.

With honor, humility, and profound admiration, we present the 4th edition of the *Emergency War Surgery* manual with the express hope that we will not forget the lessons we have learned.

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April 2013  
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## Prologue

*"War is the only proper school for the surgeon."*  
— Hippocrates

Within the last century, our wars have traveled from the hedgerows of Europe and beaches in the Pacific, to the jungles of Vietnam, and now to the deserts and mountains of Southwest Asia. The common denominator of these conflicts is intense human suffering and death as a result of injury on the battlefield. Most recently, after a decade of war, what is recent past is prologue for this work: more than 5,000 dead and tens of thousands of combat casualties with significant injury in the decade from 2001 to 2011. Per the philosophy of Hippocrates, "What have we learned?" and, more importantly, how can we pass that knowledge along to those who will follow? As the concept of modern warfare has changed, so, too, has medical care evolved on the battlefield. The current contingency operations have produced medical advances that will be our legacy and the new foundations for the military surgeons of the future.

War surgery today is about using evidence and best practice to optimize care of our wounded warriors. Although grounded in the fundamental training of the general surgeon and surgical specialist, it must be adaptive to the challenges of extremely high injury acuity, the burden of overwhelming casualty numbers, long and unforgiving hours, environmental extremes, logistical austerity, and the reality that mission accomplishment may precede medical necessity. It is a concept built on realistic experience and lessons learned over a decade of continuous conflict. War has predictably proliferated innovations in medicine and surgery. Modern technology and communication have yielded substantial impact on the battlefield, in that we are better able to use contemporary lessons learned to disseminate, educate, and change practice to mitigate casualty outcomes in relatively "real time."

Advances in combat casualty care are associated with the lowest case fatality rate in the history of warfare, a fact rendered even more remarkable by the complexity of injury and expedited

transcontinental evacuation of casualties across the globe. Within this realm of medical innovation, one of the most important contemporary advances to military medicine on the battlefield has been the development and implementation of the Joint Trauma System, a system whose singular vision is that every soldier, Marine, sailor, or airman injured on the battlefield or in the theater of operations has the optimal chance for survival and maximal potential for functional recovery. The motto of the system is “Right Patient, Right Time, Right Place, Right Care.” The trauma system is built on the infrastructure of the Department of Defense Trauma Registry (DoDTR), in that data improve medical care; that data drive doctrine, policy, and decision-making; and that data create new knowledge to further the evolution of battlefield care. Pertinent to the casualty and the surgeon, the mission of the Joint Trauma System is to improve trauma care delivery and patient outcomes across the continuum of care, utilizing continuous performance improvement and evidence-based medicine. Value of the trauma system is evidenced by development of more than 36 evidence-based battlefield relevant Clinical Practice Guidelines (CPGs) that have decreased morbidity and mortality from combat injury. Relevant CPGs are cited extensively in this version of *Emergency War Surgery*.

Furthermore, the antiquated system of prehospital care espoused by Pre-Hospital Trauma Life Support (PHTLS) has been ubiquitously supplanted by the paradigm of Tactical Combat Casualty Care (TCCC), divided into phases depending on the tactical scenario. In each phase, the greatest potential threat to life is managed as a priority in the context of mission capability and mission completion. Embedded within the overarching concept of TCCC are hemorrhage control and airway management. Tourniquet utilization has become a fundamental pillar of hemostasis in TCCC and has been shown to be associated with an attributable survival advantage.

Developers of the technique of balanced resuscitation coined the term “damage control resuscitation.” It was conceptualized on this battlefield and has reduced the mortality rate of massive transfusion casualties from 40% to less than 20%. Further refinements of this resuscitation paradigm include the use of



novel hemostatic agents, coagulopathy testing modalities, and even mobile resuscitative team strategies.

Even with all of the advances that have taken place on the battlefield in the last decade, several challenges loom on the horizon. Despite the lowest case fatality rate in history, the “died of wounds rate” remains largely unchanged. The vast majority of combat casualties die on the battlefield before ever reaching a medical treatment facility. Therefore, the greatest chance to impact combat casualty care occurs long before the surgeon ever has the opportunity to stop the bleeding. The charge to the generation of surgeons reading this text is to make this situation better.

It is the earnest hope of the authors of this *Emergency War Surgery* handbook that it will gather dust on the shelves of tomorrow’s military surgeon, knowing all too well that with predictable certainty that far too soon the “balloon will go up” and military surgeons will once again heed the call.

There is no greater calling, nor greater responsibility, nor greater sense of worth than to care for a wounded brother-in-arms.

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