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978-1-107-03826-4 - Trauma Anesthesia: Second Edition
Edited by Charles E. Smith
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CAMBRIDGE
UNIVERSITY PRESS

University Printing House, Cambridge CB2 8BS, United Kingdom

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www.cambridge.org
Information on this title: www.cambridge.org/9781107038264
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First published: 2008
Second edition 2015

Printed in the United Kingdom by TJ International Ltd. Padstow
Cornwall
*A catalogue record for this publication is available from the British
Library*

Library of Congress Cataloging-in-Publication Data
Trauma anesthesia (Smith)
Trauma anesthesia / edited by Charles E. Smith. – Second edition.
p. ; cm.
Includes bibliographical references and index.
ISBN 978-1-107-03826-4 (Hard back : alk. paper)
I. Smith, Charles E., 1956– , editor. II. Title.
[DNLM: 1. Anesthesia. 2. Wounds and Injuries. 3. Critical
Care. 4. Perioperative Care. WO 200]
RD93.93
617.9’604–dc23 2015004553

ISBN 978-1-107-03826-4 Hardback

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accurate and up-to-date information which is in accord with
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Although case histories are drawn from actual cases, every effort
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Contents

List of contributors vii

Foreword by Brendan M. Patterson xi

Foreword by Martin Giesecke xii

Foreword by Adolph H. (Buddy) Giesecke xiii

Foreword by Mark A. Malangoni xiv

Preface xv

Acknowledgments xvi

Section 1 – Initial management of the trauma patient

1. Mechanisms and demographics 1

Joseph F. Golob Jr. and John J. Como

2. Trauma in the prehospital environment and the emergency department 6

Sandra Werner

3. Trauma airway management 27

E. Orestes O’Brien and William C. Wilson

4. Shock management 65

Richard P. Dutton

5. Establishing vascular access in the trauma patient 79

Matthew A. Joy, Donn Marciniak, and Kasia Petelenz Rubin

6. Massive blood transfusion in trauma care 93

Joshua M. Tobin

7. Blood loss: does it change my intravenous anesthetic? 105

Ken Johnson and Talmage D. Egan

8. Fluid and blood therapy in trauma 113

Maxim Novikov and Charles E. Smith

Section 2 – Techniques for monitoring, imaging, and pain relief

9. Monitoring the trauma patient 137

Elizabeth A. Steele, P. David Soran, Donn Marciniak, and Charles E. Smith

10. Use of echocardiography and ultrasound in trauma 158

Colin Royse and Alistair Royse

11. Imaging in trauma 174

Claire Sandstrom

12. Ultrasound procedures in trauma 191

Paul Soeding and Peter Hebbard

13. Pharmacology of neuromuscular blocking agents and their reversal in trauma patients 209

François Donati

14. Hypothermia in trauma 223

Eldar Søreide, Kristian Strand, and Charles E. Smith

15. Pharmacologic management of acute pain in trauma 244

Shalini Dhir, Rakesh V. Sondekoppam, and Sugantha Ganapathy

16. Regional anesthesia 267

Shalini Dhir, Ranjita Sharma, and Sugantha Ganapathy

17. Posttrauma chronic pain 304

David Ryan, Yashar Eshraghi, and Kutaiba Tabbaa

18. Damage control in severe trauma 323

Michael J. A. Parr and Ulrike Buehner

19. Mechanical ventilation of the patient following traumatic injury 340

Roman Dudaryk, Earl Willis Weyers, and Maureen McCunn

Section 3 – Anesthetic considerations

20. Head trauma: surgical issues 353

Shoji Yokobori, Khadil Hosein, and M. Ross Bullock

21. Head trauma: anesthetic considerations and management 364

Armagan Dagal and Arthur M. Lam

v

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Contents

| | | |
|-----|--|-----|
| 22. | Surgical considerations for spinal cord trauma | 382 |
| | Cynthia Nguyen and Timothy Moore | |
| 23. | Anesthesia for spinal cord trauma | 394 |
| | Armagan Dagal and Arthur M. Lam | |
| 24. | Oral and maxillofacial trauma: surgical considerations | 412 |
| | Marcello Guglielmi, Rishad Shaikh, Ketan P. Parekh, and Cecil S. Ash | |
| 25. | Anesthesia for oral and maxillofacial trauma | 426 |
| | Olga Kaslow and Elena J. Holak | |
| 26. | Eye trauma and anesthesia | 437 |
| | Martin Dauber and Steven Roth | |
| 27. | Musculoskeletal trauma | 446 |
| | Heather A. Vallier | |
| 28. | Anesthesia considerations for musculoskeletal trauma | 471 |
| | Jeff Gadsden | |
| 29. | Cardiac and great vessel trauma | 482 |
| | Leonardo Canale, Inderjit Gill, and Christopher Smith | |
| 30. | Anesthesia considerations for cardiothoracic trauma | 499 |
| | Mark A. Gerhardt and Glenn P. Gravlee | |
| 31. | Abdominal trauma: surgical considerations | 526 |
| | Jeffrey A. Claridge and Jana Hambley | |
| 32. | Anesthetic considerations for abdominal trauma | 537 |
| | Henry G. Chou and William C. Wilson | |
| 33. | Intraoperative one-lung ventilation for trauma anesthesia | 555 |
| | George W. Kanellakos and Peter Slinger | |

Section 4 – Special populations

| | | |
|-----|--|-----|
| 34. | Pediatric trauma and anesthesia | 569 |
| | M. Jocelyn Loy | |
| 35. | Intensive care unit management of pediatric brain injury | 594 |
| | Maroun J. Mhanna, Elie Rizkala, and Dennis M. Super | |
| 36. | Trauma in the elderly | 609 |
| | Jeffrey H. Silverstein | |
| 37. | Trauma in pregnancy | 623 |
| | John R. Fisgus, Kalpana Tyagaraj, and Vanetta Levesque | |
| 38. | Field anesthesia and military injury | 640 |
| | Nicholas T. Tarmey, Claire L. Park, Craig C. McFarland, and Peter F. Mahoney | |
| 39. | Burn injuries: critical care in severe burn injury | 657 |
| | Charles J. Yowler | |
| 40. | Anesthesia for burns | 666 |
| | Jessica Anne Lovich-Sapola | |

Section 5 – Organization of trauma management

| | | |
|-----|---|-----|
| 41. | Prevention of injuries | 689 |
| | James S. Davis and Carl I. Schulman | |
| 42. | Trauma systems, triage, and transfer | 698 |
| | John J. Como | |
| 43. | Trauma team training and simulation: creating safer outcomes | 709 |
| | Paul Barach | |

Index 724

See colour plate section between pages 368 and 369.

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Foreword to the second edition

Trauma represents one the most serious threats to public health in developed countries. In the United States, trauma represents a broad spectrum of disease and is the leading cause of death and disability among young patients. Trauma claims more lost quality life years than cancer or cardiovascular disease and sadly often robs a society of its youth. However, each and every day through the thoughtful and dedicated effort of many skilled trauma providers working in complex systems we have successfully mitigated the impact of injury on countless numbers of the seriously injured. Lives are saved, limbs are preserved, and function is restored at a level considered unreachable less than a decade ago. Many of the advancements upon which these gains have been achieved rest upon improvements in resuscitation, anesthesia, advanced monitoring, and timely surgical intervention.

Modern trauma care has evolved since the last edition of this valued textbook, and the editors and authors have further defined and updated the role of anesthesia and anesthesiologists in the expert management of patients with major injury. As the rearing of children “takes a village,” the care of major trauma “takes a system.” Care of the seriously injured requires a team of providers working in a hospital that is part of a complex larger system. System thinking within and beyond the hospital setting is essential for the management of trauma care.

The role of the anesthesiologist in trauma care has expanded over the past several years with the development of early appropriate care protocols and the emphasis on timely

surgery. Early appropriate care establishes a framework for decision making across multiple disciplines engaged in trauma care and highlights the importance for ongoing resuscitation from induction of anesthesia, through time-sensitive surgery and transfer from the operating suite to the surgical intensive care unit. The anesthesiologist also plays a central role in pain management in the early postoperative period, one of the most challenging and important issues in the patient experience. This text addresses the important and ever-changing issues in the management of trauma patients. The chapters herein comprehensively address a broad range of clinical conditions and the complexity of anesthesia-related care of trauma patients.

This book provides expert insight into the many facets of trauma anesthesia, trauma surgery, pain management, and coordinated care of the injured in complex systems and across the continuum from accident through recovery. The editors and the authors promote best practice as it is currently done in the most influential trauma centers. The text is an indispensable resource for those with an interest in the care of injury, be it an isolated fracture or a patient with multisystem injury.

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Foreword to the second edition

In his foreword for *Trauma Anesthesia*, Adolph H. (Buddy) Giesecke, MD opened with the following statement: “Dr. Charles E. Smith has been inspiring improved anesthesia for the victims of traumatic injuries for many years. . .” This premise rings as true now as it did then. Based at Metro Health Medical Center and Case Western Reserve University School of Medicine in Cleveland, Ohio, Dr. Smith continues to be a respected lecturer and prolific author of trauma-related studies and publications. His expertise in the anesthesia care of the trauma patient supports his reputation and is well exemplified by his major contributions to this book. As with the original volume, he has chosen a group of highly respected authors who add significant substance to this new edition. *Trauma Anesthesia, Second Edition* is an engaging and informative read. It should become part of the armamentarium of all those who aspire to better care for the patient who has suffered a traumatic injury.

Appropriately, this book begins by providing the reader with an overview of the epidemiology of trauma. We quickly understand the cost of trauma, not only to the individual patient, but also to society in general. The book then moves from this broad topic to those which are more specific, allowing the reader the opportunity to review particular aspects of traumatic injury and then to see specific examinations of how one may best provide anesthetic care for these patients. It is accepted that anesthesia care for the patient with traumatic injuries has continued to evolve since the first edition of *Trauma Anesthesia*. Mirroring this evolution of anesthesia care, the information provided within this book has kept pace with those changes. Examinations of fluid resuscitation of the trauma patient, the continued fine-tuning of massive transfusion protocols, and an ongoing analysis of damage control in severe trauma are all included here. Another hot topic included in this book is monitoring of the trauma patient. There continues to be considerable morbidity associated with traumatic injuries. Besides discussions of chronic pain in the trauma survivor, the science of injury prevention is presented.

One aspect of this book that especially appeals to me is the pairing of discussions of trauma to a particular organ system or region of the body, and the subsequent presentation of anesthetic considerations for patients with that particular pattern of injury. Because of this presentation of the information,

there is something in this book that will be of interest to every student of trauma care. Included are chapters on pediatric trauma, cardiac injury, head, brain and spinal cord trauma, as well as coverage of the anesthetic care for these patients. There are discussions for those whose interests lie more towards postoperative critical care (pulmonary care of the severely injured patient, operations of a trauma unit) or using simulation in education. There is an update on military injuries, and field anesthesia for treating these patients. There are chapters on burn injuries and anesthesia, as well as sections on anesthesia for the elderly patient with trauma.

When Dr. Smith first asked me to write this foreword, it was an unexpected request. Why would he want me, an unknown name in the trauma anesthesiology world, to prepare readers who open this book? My reading of the pages that follow brought back to me the presence of my father, A.H. “Buddy” Giesecke, MD. It enabled me to reflect on his career in trauma anesthesiology, and on the support he gave to those who shared his interest in trauma, in general, and in the specialty of trauma anesthesiology, in particular. Studying these pages made me more fully understand the particular attractions of trauma anesthesia, and of its physicians. Dr. Smith and my father are examples who truly fit that model of the teaching anesthesiologist.

In *Trauma Anesthesia, Second Edition*, Dr. Smith and his invited authors have once again produced an eloquently readable book. The information held within will allow the reader to better understand the nature of traumatic injuries and the relationship that the practicing trauma anesthesiologist plays in producing the best outcomes in this patient population. Though written with anesthesiologists in mind, this book will be particularly useful to any student, physician, or other health professional who spends time caring for the patient with traumatic injury. It is my desire to echo my father’s closing statement in his foreword from the original edition. Congratulations to Dr. Smith and the entire authorship for a job well done!

Martin Giesecke, MD
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Foreword to the first edition

Dr. Charles E. Smith has been inspiring improved anesthesia for the victims of traumatic injury for many years, having spent the majority of his career at MetroHealth Medical Center, Cleveland, Ohio, which is the city's major trauma center. He has regularly served as lecturer in refresher courses for the International Trauma Anesthesia and Critical Care Society (now called International TraumaCare). He is a productive author of innovative research in the care of the traumatized patient. These attributes easily qualify him to be editor of a multi-authored comprehensive book on trauma anesthesia, to which he is also a major contributor. His invited chapter authors are similarly qualified. The result is an authoritative, readable, and educational resource for the student, resident, or practitioner wishing to stay abreast of a rapidly changing field.

Epochal changes have occurred in the practice of anesthesiology in the last ten years. Improved monitors, safer drugs, and better-trained anesthesiologists, nurse anesthetists, and anesthesia assistants have all reduced the morbidity and mortality of anesthesia. Anesthesia has become safer. Safer anesthesia improves the outcome of traumatic injuries. Our surgical colleagues have contributed to the improvements in trauma care. Innovations in the care of serious fractures, use of damage control in abdominal injuries, and improved care of burns have reduced morbidity and mortality. Dr. Smith has included all of the latest innovations in this text. Despite the advances, the importance of trauma as a cause of disability and lost life remains and, in fact, when expressed as a proportion to overall mortality in young people, is increasing in importance.

Throughout history significant advances have been made in anesthetic care during times of war. The war in Iraq is no exception, and the lessons learned in that conflict are included. The technology of vascular access has greatly improved. Ultrasonic localization of major veins for central access is a major advance greatly enhancing safety for the patient. The technique of intraosseous infusion was once painful and cumbersome to establish, such that it was considered a circus stunt and not of much practical value. Newly designed equipment has revolutionized the technique. It is now fast, painless, convenient, and effective in any patient with difficult IV access. Having established vascular access, the choice and volume of fluid therapy is critical to survival and outcome of the traumatized patient.

This book discusses the established and the controversial concepts. Also discussed is a new protocol-driven, multidisciplinary approach to massive transfusion. This approach, which requires cooperation between the blood bank, the trauma surgeons, and anesthesiologists, takes the guesswork out of massive transfusion. No longer do we have to stand at the OR table and ponder, "Is it time for platelets and fresh frozen plasma?" These collaborative decisions have been made in advance, and all we have to do is to activate the protocol and administer whatever comes in the incremental allotments.

Patients now expect to be relieved of significant pain, and pain is considered the fifth vital sign. Significant advances have been made in the techniques for relief of acute traumatic and postoperative pain. Entire teams of people are now dedicated to this practice. Nobody questions the value of pain relief, but it comes with some risk. A multimodal approach appears to accomplish the goal and simultaneously minimize the risks.

Thermal injuries, brain injuries, and spinal cord injuries are specialized forms of trauma that are occasionally neglected. Not so in this text. The public health implications are presented along with the practical considerations for safe clinical management. The practical considerations are important because, for example, drugs and procedures that may be beneficial in the management of orthopedic injuries are contraindicated in neurologic injuries. We must be able to recognize these conflicts when they occur together in the same patient and create an anesthetic plan that will benefit the patient.

Dr. Smith and his invited authors have done a magnificent job of pulling together the diverse concepts of the management of the traumatized patient and presenting us with a valuable resource for the anesthesiologist. Although directed at the anesthesiologist, the text is useful for emergency medicine physicians, surgeons, orthopedists, and, in fact, any health care professional who deals with trauma. Congratulations to the entire group of authors!

Adolph H. (Buddy) Giesecke MD, Emeritus Professor

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Foreword to the first edition

The challenge of managing seriously injured patients encompasses an expanse of issues linked by a common factor – trauma. In these critical situations, anesthesiologists are often faced with the need to simultaneously address emergent airway management, resuscitation, massive blood loss, acidemia, coagulopathy, hypothermia, and the consequences of damage to various organs. The management of each of these conditions alone can be essential for survival, and their convergence presents a unique situation in which the likelihood of death or a bad outcome is real. Success in this stressful situation requires a sophisticated understanding of basic sciences and expertise in the clinical and technical skills of anesthetic management. Together, the anesthesiologist and trauma surgeon must orchestrate the human and physical resources of the trauma center with a patient's life on the line.

Recent advances in the field of trauma anesthesiology parallel those in other related medical disciplines. Concepts promulgated by experiences in recent military conflicts have affected resuscitation and the use of blood products. The adoption of damage control operations and the use of simultaneous surgical teams to address multiple critical injuries have improved survival. Rules regarding the transfusion of blood and blood components and the use of recombinant clotting factors such as Factor VII concentrate have led to a “sea change” in trauma management that has resulted in the survival of soldiers and others injured under war conditions beyond what was possible just a few years ago. These concepts have been readily adopted in civilian trauma centers. The intensity associated with their use has placed an increased

demand on anesthesiologists who are already taxed in their care for the critically injured.

This excellent book addresses these important and evolving changes in management of the injured patient as well as more traditional issues in trauma anesthesia. The breadth of topics addressed by the authors reflects the challenges and complexities of anesthesia-related care for victims of traumatic injury.

Trauma surgeons realize the tremendous importance of coordinated care promulgated at trauma centers and by trauma systems. Injury accounts for more lost productive years of life than any other disease; therefore, survival and ultimate return to an acceptable level of function are important outcome parameters both for the patient, their loved ones, and our society. Because many seriously injured patients will require an operation, the anesthesiologist is an important link in the coordinated approach to trauma care and must be aware of the unique problems related to managing injury. That is why this book is such an important contribution for anesthesiologists who care for trauma patients.

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Preface

Trauma is a leading cause of death and disability in modern society. Trauma will continue to be a leading cause of death well into the future. We are all vulnerable to traumatic injury. Managing adult and pediatric victims of major trauma and burns continues to be a great challenge requiring a tremendous amount of dedication and resources. As with the first edition, the overall aim of this textbook is to review the anesthesia considerations for trauma patients and to provide a rational approach to the choice of anesthetic techniques and drugs. Nearly all authors from the first edition were asked to review and revise their chapters in order to reflect recent changes in the field of trauma anesthesiology. In addition, six new chapters have been added to make a total of 43 chapters, and the second edition of *Trauma Anesthesia* has been reorganized into five sections as follows: (1) *Initial management of the trauma patient*, which includes a new chapter on trauma in the prehospital environment and the emergency department; (2) *Techniques for monitoring, imaging, and pain relief*, including a new chapter highlighting major advances in diagnostic and interventional radiology for victims of blunt and penetrating trauma; (3) *Anesthetic considerations*, including new chapters on surgical issues in head trauma, anesthesia for oral and maxillofacial trauma, and surgical considerations in abdominal trauma; (4) *Special populations*; and (5) *Organization of trauma management*, which includes a new chapter on prevention of injuries.

I have been fortunate in assembling an outstanding group of clinicians who regularly care for trauma patients at major trauma centers. The authors provide an in-depth discussion of

their areas of expertise, and concentrate on clinical aspects of trauma management. I have selected members of my hospital to assist with this textbook, as well as notable contributors from other major centers around the globe. The 43 chapters deal in detail with pertinent areas of trauma care such as airway and shock management, monitoring, vascular access, pharmacology of anesthetic drugs, fluid and blood resuscitation, and the treatment of acute and chronic pain after injury. For several patterns of injuries, including head, spinal cord, oral and maxillofacial, extremity and pelvis, abdomen, cardiac and great vessel, and burns, surgical considerations and management principles are presented to the reader in the chapter preceding the one dealing with anesthetic considerations. Specific chapters review the anesthesia considerations of vulnerable patient populations such as elderly, pediatric, pregnant, and military patients. Other sections deal with important issues of trauma care including damage control in severe trauma, hypothermia in trauma, mechanical ventilation following traumatic injury, and use of echocardiography and ultrasound in trauma. Training for trauma, including the use of simulation, and the role of trauma care systems in facilitating the allocation of resources for optimally managing injured patients, are also covered.

As with the first edition, I hope that this text will be of use for anesthesia care providers who are faced with caring for trauma patients at all hours of the day and night. I am certain that the text will benefit anesthesia residents and staff of major trauma centers, help pave the way to improved care of the injured, and stimulate future advances in trauma care.

Acknowledgments

I would like to thank my mentors in anesthesia from McGill University, David Bevan, François Donati, Earl Wynands, and Jamie Ramsey, for providing teaching and inspiration, instilling in me the confidence to manage complex patients, and stimulating my interest in clinical research. I am indebted to all the staff at MetroHealth Medical Center who work long and hard to transport, stabilize, diagnose, treat, and rehabilitate victims of blunt and penetrating injury. Thanks to my associate editor and colleague, John Como, and to the many contributors to this book for sharing their experience and knowledge. I am grateful to the staff of Cambridge University Press for their tireless efforts in seeing this book through to publication: Nisha Doshi, Joanna Chamberlin, Deb Russell, Beata Mako, Hugh Brazier, Ross Higman, and Divya Mathesh. I would also like to thank my colleagues at the Trauma Anesthesiology Society

and Committee on Trauma and Emergency Preparedness for their friendship, support, and vision in caring for trauma patients: Albert Varon, Rick Dutton, Marc Steurer, Maureen McCunn, Jean-François Pittet, Arman Dagal, Olga Kaslow, Mike Murray, Josh Tobin, Carin Hagberg, Uday Jain, Jay McIsaac, Tony Chang, Bert Pierce. I also note the passing of one of the greatest trauma anesthesiologists of our time, Buddy Giesecke, who inspired me to learn more about trauma, and was a source of strength, guidance, friendship, and support. The love and encouragement of my parents Thelma and David, my children Adrienne, Emily, and Rebecca, and my granddaughter Sweet Baby Jane was ever present and much appreciated.

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