

SHOCK TRAUMA/ CRITICAL CARE MANUAL

Initial Assessment and Management

Edited by

R Adams Cowley, M.D.

C. Michael Dunham, M. D.



1985年6月27日

SHOCK TRAUMA/ CRITICAL CARE MANUAL

Initial Assessment and Management

Edited by

R Adams Cowley, M.D.

Director

and

C. Michael Dunham, M.D.

Attending Traumatologist

Maryland Institute for Emergency
Medical Services Systems
Baltimore, Maryland



University Park Press
Baltimore



UNIVERSITY PARK PRESS
International Publishers in Science, Medicine, and Education
300 North Charles Street
Baltimore, Maryland 21201

Copyright © 1982 by University Park Press

Typeset by University Park Press, Typesetting Division
Manufactured in the United States of America by The Maple Press Company

Cover photograph courtesy of MIEMMS, Public Relations Division.

All rights, including that of translation into other languages, reserved. Photomechanical reproduction (photocopy, microcopy) of this book or parts thereof without special permission of the publisher is prohibited.

R Adams Cowley, M.D.
Director

and

C. Michael Dunham, M.D.
Attending Traumatologist

Maryland Institute for Emergency
Medical Services Systems
Baltimore, Maryland

Library of Congress Cataloging in Publication Data
Main entry under title:

Shock trauma/critical care manual.

Includes index.

1. Emergency medicine—Handbooks, manuals, etc.
2. Shock—Handbooks, manuals, etc. I. Cowley, R Adams, 1917- II. Dunham, C. Michael. [DNLM: 1. Wounds and injuries. 2. Critical care—Methods. 3. Emergency medicine—Methods. WO 700 S559]

RC86.7.S463

616 .025

ISBN 0-8391-1712-4

AACR2

Preface

This book is the culmination of work over a number of years in the development of an evolutionary clinical program on the assessment and management of the critically ill and injured patient. When the shock trauma program was conceived 20 years ago, there was no existing model care system for the acute management of the severely injured and ill patient. From our experience in this program we developed our philosophy and treatment protocols into a teaching manual. As the program developed and our knowledge increased, the manual was expanded, updated, and refined each year. Thus, what is presented here is our current experience on the management of multiple trauma and critical care problems, as seen in the Shock Trauma Center at the Maryland Institute for Emergency Medical Services Systems.

Unlike other publications, this book focuses only on the clinical problems that are seen daily in a large trauma/critical care center. A conscientious effort has been made to include all necessary aspects of successful patient management during the acute phase of illness. We have tried to make the information as clinically relevant as possible, and have purposefully deleted or minimized historic and pathophysiologic information to avail maximum space for the presentation of our experience in the day-to-day management of catastrophic injury and illness.

We strive to provide many answers to questions asked about the acute management of these victims. It is our hope that this manual will provide a practical and ready clinical reference for the surgeon, the anesthesiologist, the critical care specialist, the emergency room physician, the nurse, and the house officer. We have included guidelines on general procedures for various critical problems, immediate resuscitation, stabilization, and diagnosis and treatment. We have developed extensive expertise in the management of multiple system injuries, the ruptured aorta, chest contusion, and abdominal, central nervous system, and extremity injuries; these injuries are presented in depth in this volume. Cross-references to supplemental information are listed in parentheses throughout the book.

Many authors of surgical trauma books deal extensively with penetrating wounds, and most physicians who come into our program already have a generous experience with penetrating wounds from the war in Vietnam and the upsurge in violent crimes. Their experience with blunt trauma, however, is often minimal. Both types of injuries are discussed in this work, with greater emphasis being placed on life-threatening blunt injuries.

In our hands this manual has been of significant assistance in minimizing death and permanent disability. It has also provided a useful educational tool in this clinical arena.

Large community and university hospitals can no longer pretend to be everything to everyone. More comprehensive management systems must evolve to provide the necessary care for survival of the acutely injured and ill patient. Therefore, in the emergency management of these unfortunate victims, the first objective is to *save the life*. The second objective is to prevent disability. The third objective is to provide a rehabilitation system that will return the patient to an active and productive life. The final objective is to make such a dedicated program cost-effective. These objectives require constant surveillance, scrutiny, and creativity if the goal of optimal care is to be met. The concept of holistic care also becomes an important element of our philosophy and demands teamwork at every level, especially in rehabili-

tative care. A change in thinking about this latter aspect, as it relates to acute care, is required if we are to lessen disability.

Finally, hypoxia, the destroyer of all life, insidiously tears down the biochemical energy-transducing systems so necessary for survival. Therefore, the message throughout this book is to prevent hypoxia: maintain ventilation, control the hemorrhage, and maintain optimal tissue perfusion.

R Adams Cowley, M.D.

C. Michael Dunham, M.D.

We strive to provide many answers to questions asked about the acute management of these victims. It is our hope that this manual will provide a practical and ready clinical reference for the surgeon, the anesthesiologist, the critical care specialist, the emergency room physician, the nurse, and the house officer. We have included guidelines on general procedures for various critical problems, immediate resuscitation, stabilization, and diagnosis and treatment. We have developed extensive expertise in the management of multiple system injuries, the ruptured aorta, chest contusion, and abdominal, central nervous system, and extremity injuries; these injuries are presented in depth in this volume. Cross-references to supplemental information are listed in parentheses throughout the book.

Many authors of surgical trauma books deal extensively with penetrating wounds, and most physicians who come into our program already have a generous experience with penetrating wounds from the war in Vietnam and the upsurge in violent crimes. Their experience with blunt trauma, however, is often minimal. Both types of injuries are discussed in this work, with greater emphasis being placed on life-threatening blunt injuries.

In our hands this manual has been of significant assistance in minimizing death and permanent disability. It has also provided a useful educational tool in this clinical arena.

Large community and university hospitals can no longer pretend to be everything to everyone. More comprehensive management systems must evolve to provide the necessary care for survival of the acutely injured and ill patient. Therefore, in the emergency management of these unfortunate victims, the first objective is to save the life. The second objective is to prevent disability. The third objective is to provide a rehabilitation system that will return the patient to an active and productive life. The final objective is to make such a dedicated program cost-effective. These objectives require constant surveillance, scrutiny, and creativity if the goal of optimal care is to be met. The concept of holistic care also becomes an important element of our philosophy and demands teamwork at every level, especially in rehabilitation.

Acknowledgments

My deep personal gratitude is expressed to C. Michael Dunham, my co-editor. He, more than anyone, has made the publication of this manual possible.

Both of us are indebted to the many physicians, nurses, and administrative personnel who participated in the 20-year clinical evolution of the MIEMSS shock trauma program. They gave generously of their time in writing up each clinical procedure performed in caring for our patients. I wish I could mention and personally thank each individual; they have not been forgotten for their contribution. Space prevents naming all those who have made a contribution to the program. A special thanks goes to Dr. William S. Stone, former Dean of the University of Maryland Medical School, and Dr. Sam F. Seeley, Brig. Gen. USMC (Ret.), for their constant encouragement and advocacy of the program over the years of its development.

Special appreciation goes to my present clinical staff and consultants, listed below, who gave of their time and expertise in the preparation of this manual.

Mr. John Ashworth	Dr. Dorothy Gordon	Dr. Thomas Phillips
Ms. Sandra Bond-Lillicropp	Mr. Alex Gretes	Dr. Ameen Ramzy
Dr. David Boyd	Dr. J. Alex Haller	Dr. Ken Ransom
Dr. John Britten	Dr. Kirk Hamilton	Dr. Richard Richards
Dr. Sheldon Brotman	Dr. John Hoopes	Dr. Aurelio Rodriguez
Dr. Bruce Browner	Dr. Alexander Kuehl	Dr. Thomas Saul
Dr. Ellis Caplan	Dr. Larry Leonard	Ms. Elizabeth Scanlan
Dr. Peter Chodoff	Dr. Thomas Majerus	Ms. Ann Scanlon
Dr. Alasdair Conn	Dr. Paul McClelland	Dr. Bruce Shack
Dr. Everard Cox	Dr. Frank McCormack	Dr. Clayton Shatney
Dr. Raymond Curtis	Dr. Paul Manson	Dr. Carl Soderstrom
Dr. Ben Dawson	Dr. Peter Margand	Dr. Joseph Sperrazza
Dr. A. Lee Dellon	Dr. Edmund Middleton	Dr. John Stene
Dr. Thomas Ducker	Dr. Philip Militello	Dr. Benjamin F. Trump
Dr. C. Michael Dunham	Dr. Roy Myers	Dr. Stephen Z. Turney
Ms. Marge Epperson	Dr. Ole Otteson	

They drew on the work of predecessors and updated and refined each chapter to reflect our most current techniques in managing catastrophic medical problems. In addition, this work would not have been possible without the patient cooperation and sacrifice of the families who supported the staff during the long hours of manuscript writing.

Our secretarial staff must also be acknowledged for the painstaking care given in typing the many manuscript drafts.

Finally, a special acknowledgment goes to Ruby Richardson of University Park Press. Her personal interest and enthusiasm for the publication of this manual, her broad knowledge and attention to detail, and her support and encouragement to the staff were invaluable.

R. Adams Cowley

Introduction

Trauma is responsible for the deaths of more than 150,000 persons in the United States every year. An additional 10 to 17 million are disabled annually as a result of trauma, 380,000 of them permanently. Trauma ranks as the third greatest killer in the United States, surpassed only by heart disease and cancer. Yet the impact of trauma on American society is not adequately reflected in these statistics, grim as they are. Whereas cancer and heart disease typically strike in middle or late life, the toll of trauma falls disproportionately on the young. More Americans between the ages of 1 and 44 die as a result of trauma than from any disease. Accidents alone kill four times more children (1-14 years) than the next leading cause of death, and motor vehicle accidents by themselves account for 38% of deaths among those aged 15 to 24. Trauma causes three quarters of all mortality among teenagers and young adults. It extinguishes lives that have just entered their productive years, and taxes heavily one of society's most valuable assets—its young people. The cost of trauma goes far beyond what is spent on initial emergency care, although that sum in itself is enormous. The unseen costs of trauma are measured in decades of lost productivity and earnings, in families left without a chief provider, and, frequently for those who survive the injury, in a lifetime of expensive rehabilitation and therapy. The total costs of trauma to society therefore probably exceed those associated with the other major types of illness.

Thus, the crisis in medicine today is in the delivery of emergency care. For the two greatest killers, cancer and heart disease, new discoveries are needed to reduce mortality, and national institutes have been established with federal funding to do the requisite research. For trauma, a systems approach is needed to meet the specific challenges trauma presents.

Such a revolutionary systems approach to the treatment of shock and traumatic injuries began in Maryland in 1960. A clinical shock trauma unit was established in Baltimore through a contract with the U.S. Army Office of the Surgeon General, with the overall goal of ensuring every citizen's right to the best emergency care regardless of type of illness or injury, its severity, the patient's financial circumstances, or geographic location. A simple proposal was made: bring the hospital's resources to the patient by building the hospital around the patient. The patient would not be moved. Every resource would be adjacent and readily available. Everything needed for the patient's care and for the study of the patient's condition would be there. Medical knowledge as well as the patient's well-being would therefore be advanced at the same time. The success of this pilot unit led to the awarding of a NIH Research Facilities grant in 1963 to build a model facility devoted exclusively to the critically ill or injured patient. This model facility, the Shock Trauma Center, after many years of research, trial, and error, was completed in 1969.

During these years of initial organization, it was learned that the first 60 minutes, "the golden hour," after a life-threatening incident dictates whether a patient will live or die. Another factor influencing survival is access to an emergency medical system providing on-site resuscitation, evaluation, triage, and communication and transportation with care en route to a definitive care facility. The Maryland group, therefore, set out with the cooperation of the Maryland State Police Air Med-Evac System and ambulance services statewide to formalize an emergency health care delivery system with the primary goal of saving lives and

coordinating emergency health efforts throughout the state (see Appendix section on Trauma/Emergency Medical Services Systems).

In 1971, a plan for the development and organization of a statewide, systematized emergency medical services program for Maryland was written and submitted to the Governor. The plan was based on a regional concept and encompassed communications, transportation, education, training, implementation, and evaluation. On February 26, 1973, the Governor by executive order created a Division of Emergency Medical Services to implement this program and complement the University of Maryland Center for the Study of Trauma.

In 1977, legislation was passed amalgamating the emergency medical services program with the Shock Trauma Center into the Maryland Institute for Emergency Medical Services Systems (MIEMSS), an autonomous institution on the campus of the University of Maryland at Baltimore. This merger combined the educational, research, and professional expertise of the academic and clinical programs with the state emergency medical services system.

Today MIEMSS is the clinical core of the state's emergency medical services system. As a public institution its mission is to make available specialized patient care, develop new concepts of care, and provide educational and research resources to those institutions, agencies, and citizens of the state of Maryland as well as others who wish to study shock and trauma and emergency medical services problems. In addition, MIEMSS provided the impetus to the formation of an eight-state EMS council to raise emergency care in the region to state-of-the-art standards.

MIEMSS' first responsibility is to save life and prevent disability. The overall care of the severely ill or injured patient is beyond the capabilities and experience of any individual physician. Thus a holistic approach to treatment and the cooperative efforts of a multidisciplinary team of specialists at the attending staff level are required.

On admission, all patients are assumed to be dying and much of the "golden hour" for total stabilization has passed. Thus, the fight for survival begins immediately. Treatment begins before diagnosis—a necessary break with tradition. Resuscitation and stabilization have priority as many victims would die awaiting an accurate diagnosis.

MIEMSS' basic philosophy is to provide total preparedness for any life-threatening injury. This requires the immediate availability of seasoned experts to manage the clinical program 24 hours a day, 7 days a week. MIEMSS receives those patients whose only chance for survival is through the aggressive, state-of-the-art care that MIEMSS offers. Criteria for admission include any of the following: severe injuries (two or more body systems), head and spinal cord injuries, cardiac and major vessel injuries, uncontrolled shock from any cause, multiple injuries with complications (e.g., shock, sepsis, organ failure), severe facial and eye injuries, burns, gas gangrene, and carbon monoxide and other poisonings, including attempted suicides.

In managing life-threatening problems, unplanned therapy can be disastrous. Indecision and procrastination with therapy is hazardous. Because of the urgency and the type of patient treated, standardized modes of therapy have been developed and are the substance of this book.

These standard treatment protocols offer the advantages of 1) a single coordinated approach to patient care problems, 2) standardization of training, 3) facilitation of research and evaluation via a standard data base, and 4) a basis for legal standards for trauma care.

The probability of patient survival is greatly improved when time is not wasted by the team determining a possible care plan. Communication between the physician, nurse, and paramedic is simplified. All team members know their roles and tasks. Thus, they function independently, automatically, and efficiently throughout the resuscitation and stabilization phase. In addition, the protocols ensure that essential steps are not inadvertently left out or forgotten, jeopardizing the treatment plan.

Protocols facilitate planning and conducting of an extensive training program. The didactic content of lectures is based on the educational requirements needed to understand and perform the treatment protocols used at MIEMSS. Psychomotor skills are also taught to ensure proper technique.

Standardized protocols provide a concrete basis by which to measure the quality of patient care provided by new treatment protocols undergoing trial. The morbidity and mortality of different treatment modes can also be evaluated, providing a mechanism to change and improve patient care.

This protocol system provides the accepted standard for trauma care in the State of Maryland. Treatment protocols are reviewed yearly by MIEMSS' Protocol Review Committee. Each protocol is updated by the appropriate specialist to reflect the state of the art. Then the committee, consisting of the Director, the Clinical Director, the Chief of Traumatology, the Chief of Anesthesia/Critical Care, and the Director of Nursing, approves the proposed changes.

MIEMSS' clinical operation and philosophy can be better appreciated by following the course of a patient through the various care units.

The Admitting Areas, where the initial resuscitation, evaluation, and stabilization procedures outlined in this book are conducted, are always prepared for the admission of patients with life-threatening injuries. Loaded intravenous lines, surgical packs, monitoring devices, and resuscitation and diagnostic equipment stand ready. Once the estimated time of arrival is known, one of the four trauma teams is immediately mobilized. An anesthesiologist and a nurse are dispatched to the helipad to await the arrival, while the remainder of the team, consisting of the Team Leader (a surgeon), a trauma nurse, an anesthesiologist, and one or more surgical or emergency room residents, stand ready for the patient's arrival in the Admitting Area. There is no waiting. Radiographic equipment, blood, and all other life-saving components are available on the spot. If necessary, the patient can be moved a few steps to the adjacent operating room. All patient admissions are the responsibility of the Team Leader under the immediate supervision of the senior attending physician. The Team Leader directs the resuscitation, stabilization, and triage of all patients.

The surgeon and the anesthesiologist discuss the surgical and anesthetic plan before surgery is started. They act as a team throughout the surgical procedure and during the post-operative phase. Decisions regarding patient care are made according to the protocol system described.

The Team Leader has the responsibility for care throughout the patient's hospital stay. The Team Leader and the primary nurse for each nursing unit, supported by multidisciplinary specialists and therapists, participate in the patient's total care. A consultant writes patient orders in an emergency when the Team Leader or designate is not available. Should a consultant need to write orders, the Team Leader is immediately notified of the action.

Once stabilized in the Admitting Area or operating room, the patient is moved to the 12-bed, sophisticated Critical Care Recovery Unit (CCRU). There the patient is closely monitored, and all orders are reviewed and rewritten. A chest x-ray, EKG, lab profile, and any other pertinent data are ordered at the time of admission to the CCRU. When a patient is ready for transfer from the CCRU to another unit, the team summarizes the patient's course and writes the necessary orders. Routine transfers occur at 4:30 p.m.; transfers may be made at other times according to bed requirements. The shift charge nurse coordinates all non-routine transfers with the Team Leader or designate.

The Team Leader and the primary nurse are responsible for family contact and support. Telephone contact is maintained with the family spokesperson by the primary nurse. All information given to the family about the patient's condition is cleared with the Team Leader; the Team Leader partakes in as many communications as possible with the patient's family. Through participation in patient rounds, the nursing staff is aware of all changes in treatment, prognosis, and clinical plans.

As the patient improves beyond the need for the highly specialized CCRU care, he or she progresses to a special intensive care unit (ICU) similar to those in other hospitals. When the patient enters the ICU, all previous orders are reviewed and revised as necessary. The ICU primary nurse works with the Team Leader and the disposition coordinator in making rehabilitation and discharge plans for the patient.

Intermediate care at MIEMSS is dedicated as a unit to helping the patient adapt to the environment within the confines of any post-trauma disability. As a process this involves dealing with the patient's total needs, including psychosocial and physical needs. The family now becomes an integral part of the patient's care in reorientation, teaching, and discharge planning, and in helping the family and the community to reincorporate the patient as a useful citizen.

The trauma team coordinates with the nursing staff of the intermediate care unit (IMCU) the smooth transition of the patient from other units to this facility. The mix of patients is quite broad and includes those who are stable with limited injuries and who do not require intensive nursing or electronic monitoring, those who are awaiting the completion of discharge disposition arrangements, and those who are staying at MIEMSS for rehabilitation or follow-up surgery. Patients transferred to the IMCU ordinarily do not require monitoring devices, are not on respirators, do not require balanced traction, and have stable vital signs. Occasionally, patients will be electively admitted to this unit for follow-up surgery or for hyperbaric medicine treatment.

The IMCU primary nurse coordinates and expedites the reorientation of the patient and the follow-up arrangements for the patient prior to discharge. The Team Leader is aware of patient needs and makes regular rounds to include nursing requests for medical assistance. Discharge then is to a rehabilitation hospital, a hospital near the patient's home, a nursing home, or the patient's own home. Should complications occur, the patient is returned to a more specialized unit.

The support functions at MIEMSS are also essential for saving lives. Because of the need for immediate and frequent laboratory data, MIEMSS maintains its own Clinical "Stat" Laboratory. Staffed 24 hours a day, the lab can return most test results within 10 minutes.

Radiologic examinations are carried out in the Admitting Area as well as in the CCRU and the step-down units. Special contrast studies are made in the Radiology Department. Uncrossmatched blood and blood components are always available in MIEMSS' mini-blood

bank. MIEMSS cooperates with the University of Maryland Hospital blood bank for the larger amounts of blood and blood derivatives required. A multidisciplinary Family Services branch offers psychosocial help both to patients and their families, crisis intervention and counseling during their stay, and assistance with discharge planning. Psychiatric consultation is always available for patients and staff.

To reduce disability, rehabilitation should ideally begin at the time of injury and continue throughout definitive care. Prevention, maintenance, and restoration are major elements in the rehabilitation process; integration of the appropriate elements at the right time and place facilitates recuperation and patient adjustment. The program is based on individual patient assessment. Most patients need intensive rehabilitation following stabilization and during recovery from trauma. Early evaluation by rehabilitation personnel determines when and which specific therapies should be used. Joint patient rounds and discharge planning conferences are held to facilitate continuity of care.

Research is pursued on both basic and clinical laboratory levels. Physicians, nurses, and researchers are constantly seeking ways to improve patient care. No clinical study is made that would endanger the patient, and all studies comply completely with the University's Human Volunteers Committee.

Professional educational opportunities include 1- and 2-year fellowships in traumatology, critical care medicine, and research. MIEMSS also sponsors training programs for physicians, nurses, emergency medical technicians, and paramedic and helicopter crews. In-house and outreach programs as well as state and national seminars and conferences are available in addition to public education programs.

The education and research functions are less dramatic than the life-saving measures of patient care, but just as important. Research efforts have allowed us continually to provide new modes of therapy, thereby reducing mortality and morbidity. The immediate autopsy program (see Chapter 39) has advanced greatly our understanding of cell injury and its relationship to survival. Current research areas receiving greatest attention at MIEMSS include systemic infection, severe head injury, and hepatic dysfunction, as these remain the chief causes of mortality after initial stabilization. Since the shock trauma unit was founded, our mortality rate has dropped from 70% to 16.3%. Our educational programs have trained numerous physicians who are now establishing and managing trauma centers throughout the country, thus allowing the expertise we have developed to be spread and the original purpose of the unit, better patient care, to be practiced elsewhere.

Contents

Preface	vii
Acknowledgments	ix
Introduction	xi
Section I INITIAL EVALUATION AND MANAGEMENT OF THE TRAUMA PATIENT	0
1 CARDIOVASCULAR ASSESSMENT AND STABILIZATION	7
2 RESPIRATORY ASSESSMENT AND STABILIZATION	15
3 EVALUATION CHECKLIST OF THE MULTIPLE TRAUMA PATIENT	21
4 EMERGENCY RADIOGRAPHY	31
5 TRANSFUSION	35
6 ANESTHETIC CONSIDERATIONS	43
7 PEDIATRIC TRAUMA	49
Section II SHOCK	56
8 PRACTICAL MANAGEMENT OF SHOCK	59
Section III SYSTEMS INJURY	69
9 HEAD AND NECK INJURIES	73
10 THORACIC INJURIES	105
11 ABDOMINAL AND PELVIC INJURIES	143
12 CENTRAL NERVOUS SYSTEM INJURIES	215
13 EXTREMITY INJURIES	241
Section IV SPECIAL CONSIDERATIONS	281
14 BURNS	283
15 GUNSHOT WOUNDS AND BALLISTICS OF WOUNDING	295
16 SOFT TISSUE INFECTIONS	297
Section V SYSTEMS FAILURE	303
17 CEREBRAL DYSFUNCTION	309
18 PULMONARY INSUFFICIENCY AND COMPLICATIONS	313
19 CARDIAC INSUFFICIENCY	335
20 RENAL INSUFFICIENCY	349
21 HEPATIC DYSFUNCTION	359
22 STRESS GASTROINTESTINAL ULCERATION	365
23 MULTIPLE SYSTEMS FAILURE	369
24 NEAR DROWNING, HYPOTHERMIA, AND SMOKE INHALATION	373
25 ALCOHOL AND OTHER DRUG-INDUCED PROBLEMS	383

Section VI INFECTION	401
26 INFECTION CONTROL AND MANAGEMENT	405
✓ Section VII NUTRITION	431
27 NUTRITIONAL SUPPORT OF THE CRITICALLY ILL PATIENT	435
✓ Section VIII PRINCIPLES, TECHNIQUES, AND PROCEDURES	457
28 ARTERIAL CATHETERIZATION	461
29 BRONCHOSCOPY	465
30 CENTRAL VENIPUNCTURE	469
31 CHEST TUBES	471
32 ESOPHAGEAL OBTURATOR AIRWAY	475
33 MILITARY ANTI-SHOCK TROUSERS	479
34 TRACHEAL INTUBATION	481
Section IX MONITORING	487
35 METABOLIC AND PHYSIOLOGIC MONITORING	491
Section X HYPERBARIC MEDICINE	497
36 CLINICAL PROBLEMS AMENABLE TO HYPERBARIC THERAPY	501
Section XI DEATH AND DYING	516
37 PROBLEMS RELATED TO THE DYING PATIENT	521
Section XII PROTOCOLS	526
38 PREHOSPITAL PROTOCOLS	531
39 HOSPITAL PROTOCOLS	533
APPENDIX	542
ADMINISTRATION	545
COMPUTERS	555
COST EFFECTIVENESS AND UTILIZATION REVIEW	557
TRAUMA/EMERGENCY MEDICAL SERVICES SYSTEMS	559
FAMILY SERVICES	571
PSYCHIATRIC CONSULTATION AND ABNORMAL BEHAVIOR	573
REHABILITATION	577
TRAUMA REGISTRY	581
TRIAGE	583
Index	587

SHOCK TRAUMA/ CRITICAL CARE MANUAL

Initial Assessment and Management

Edited by

R Adams Cowley, M.D.

Director

and

C. Michael Dunham, M.D.

Attending Traumatologist

Maryland Institute for Emergency
Medical Services Systems
Baltimore, Maryland



University Park Press
Baltimore

Section I

INITIAL EVALUATION AND MANAGEMENT OF THE TRAUMA PATIENT

1 CARDIOVASCULAR ASSESSMENT AND STABILIZATION / 7

2 RESPIRATORY ASSESSMENT AND STABILIZATION / 15

3 EVALUATION CHECKLIST OF THE MULTIPLE TRAUMA PATIENT / 21

4 EMERGENCY RADIOGRAPHY / 31

5 TRANSFUSION / 35

Resuscitative Transfusion

Massive Transfusion

Autotransfusion

Transfusion Reactions

6 ANESTHETIC CONSIDERATIONS / 43

7 PEDIATRIC TRAUMA / 49

INTRODUCTION

The multiple trauma patient is received by the admitting team on-call. Each member has a predesignated duty. In most cases, it will be necessary to institute resuscitation measures before a complete diagnostic as-

essment has been performed. The admitting team has adequate time to scrub and change uniforms prior to the arrival of the patient.

I. First Priorities

- A. Rapidly inspect the patient on arrival for skin color, alertness, chest wall motion, and extremity movement.
- B. Palpate the pulse (slow, rapid, strong, weak) and obtain a blood pressure.
- C. Auscultate the chest for the presence of breath sounds.
- D. Establish an airway and provide adequate ventilation (see p. 15).
- E. Assess whether the patient follows commands.
- F. Assess the extremity posture to noxious sternal compression.
- G. Assess the size of each pupil and determine whether the pupil reacts to light.
- H. Control external hemorrhage.
- I. Establish intravenous lines and begin volume infusion (see p. 7).
- J. Obtain admission blood work.
- K. Initiate EKG monitoring.
- L. Obtain a baseline arterial blood gas sample. The blood gas should be on room air if the patient is not intubated. The acid-base status and $\text{PaO}_2/\text{FiO}_2$ ratio can be calculated to estimate the degree of anaerobic metabolism and the pulmonary shunt (see p. 316).
- M. Stabilize the cervical spine with a hard collar and/or sandbags.

Do not become concerned with peripheral injuries until the cardiovascular, pulmonary, and neurologic systems are stabilized. The first priorities are directed at evaluating these systems, since instability poses an immediate threat to the patient's life. The first priorities are concomitantly performed by multiple team members (surgeon, anesthesiologist, and nurse).

In all but a very few situations, time exists for an adequate preparation of skin prior to the insertion of lines. **Remember:** Infection is the leading cause of death in trauma patients.

Those measures listed under "First Priorities" will normally require only a few minutes. The second and third priorities are more time-consuming.

II. Second Priorities

- A. A brief examination of the head, chest, abdomen, pelvis, and extremities is performed.
- B. Brief and pertinent history is obtained.
- C. A lateral cervical spine x-ray is obtained.
- D. An upright chest x-ray is obtained (see p. 32).
- E. An anterior-posterior (AP) x-ray of the pelvis is obtained.
- F. Insert a Foley catheter.
- G. Pass an orogastric tube.
- H. Peritoneal lavage and/or abdominal examination is performed.
- I. A more complete neurologic examination is performed (see pp. 225 and 230).
- J. Splint extremity fractures.
- K. Emergency surgery is performed, if indicated.
- L. An arterial line is inserted, if indicated (see p. 461).

III. Third Priorities

- A. Systematic examination
 1. Facial and scalp evaluation
 2. Evaluation of the extremities
 3. Rectal, pelvic, and perineal examinations
 4. Back examination