

Clinical
Management
of Shock

CLINICAL MANAGEMENT OF SHOCK

Surgical and Medical

By

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FOREWORD

THIS BOOK BY COLONEL ROBERT M. HARDAWAY brings together between two covers a wide experience in the clinical treatment and laboratory study of shock. There are few scholars, surgeons, or clinicians who can bring these various disciplines together and meld the extremes so ably as this author.

Colonel Hardaway here discusses data from man under clinical conditions, from man under highly sophisticated laboratory circumstances, and from the experimental laboratory. His particular interest and contribution have resided in the field of flow-deficiency and the local production of diffuse coagulopathy, due to the consumption of clotting factors by intravascular thrombi.

There are at least three components in his theory of diffuse intravascular coagulation: local physiologic effects, local histologic changes, and diffuse biochemical results. In this book the author reviews all three in a way which will long serve as a stimulus to the clinician, as well as to the scholar. The clinician will keep a sharper eye on the coagulation defect, and the researcher will not fail to study these features in his laboratory preparation. The possible relationship of diffuse intravascular coagulation to irreversible changes in local tissues, to widespread bleeding changes and to small pulmonary emboli are here discussed and described in detail.

Particular therapeutic steps that should be undertaken in diffuse intravascular coagulation include heparin and vasodilators. The study of these drugs, also reviewed in this remarkable book, has defined an entirely new horizon in the field of shock. From extensive clinical observations on the natural course of severely injured patients, the author includes a large section on the clinical management of all aspects of the shock problem.

Both the United States Army (as the branch of Government most keenly interested in the treatment of severe injury!) and the

American surgical research establishment as a whole can be proud of this book. As a consultant to the Walter Reed Army Institute for Research, it has been my privilege to observe at least some small fraction of this work, both in its inception and in its achievement. This book stands as a fitting consummation for this important research, bringing the message of its findings to a wider audience.

FRANCIS D. MOORE

PREFACE

WHY ANOTHER book on shock? Certainly every Boy Scout knows what it is and how to treat it. However, many of the books and articles presently available are written in generalities with neither specific data to support the opinions expressed, nor details to describe techniques advocated. In addition, many opinions expressed are based on traditional ideas and misconceptions handed down from past times when detailed studies of shock in human beings were unavailable. "The greatest mistake is to suggest, as some have done, that shock is a problem that has been solved." (1) What seems true today may not seem so tomorrow and vice versa. Most of what is taught in medical schools today was not even known when I went to school. A good deal of this new knowledge reverses or modifies "facts" which we were taught. *Nothing we know, or think we know, is the ultimate truth.*

"Although warriors have died of their wounds from the beginning of time, the first scientific approach to an analysis of how and why they die was made during World War I. In that war the wound surgeon lifted his eyes from the shattered limb to inquire with some degree of precision about the nature of the processes that a wound may initiate in the body as a whole. Because, even if the limb was amputated and every organ of the body was sound, death was likely to occur as the terminal event of a profound disturbance known as wound shock." (2)

"World War I revealed wound shock as a complex problem. Its nature was not solved nor were sufficient observational data accumulated to permit clear identification and subsequent analysis. Certain preexisting hypotheses (vasomotor exhaustion, acapnia, adrenal exhaustion) were discredited, but other concepts inadequately supported by facts (traumatic toxemia, the distinction between shock and hemorrhage) were substituted. These concepts centered on wound shock as an entity not accounted for by hemorrhage, infection, brain injury, blast, asphyxia

of cardiorespiratory origin, fat embolism, or any other clearly demonstrable lethal effect of trauma. World War I thus recognized a problem of shock but left it wrapped in mystery." (2)

"At the end of World War I the so-called shock problem was transferred to the experimental laboratories of medical science. Attempts were made to resolve it by physiologic and chemical techniques under a wide variety of experimentally induced circumstances. As the methods of initiating experimental shock were multiplied, the term itself became broadened, so that it included a number of processes that appeared to have one feature in common — a reduced effective volume flow of blood with inadequacy of the peripheral circulation and resulting tissue asphyxia. In the clinic as well as the laboratory, shock became separated from wounds, and "medical shock," "obstetrical shock," "burn shock," "shock due to infection," and other types were described as entities. So-called shock became synonymous with the process of dying from almost any cause unless death was practically instantaneous or, as Henderson (3) stated, "unless one is burned alive." The phrase, "the problems of shocks," was used by Mann (4) to describe this confusion of definition." (2)

During World War II the problem of shock was taken up by The Board for the Study of the Severely Wounded — North African-Mediterranean Theater of Operations (2) and considerable progress was made (Fig. 1.) Shock was classified as to severity, and the value of plasma and whole blood was proved.

After World War II the investigative activities diminished with the passage of time. However, the syndrome of posttraumatic renal insufficiency had been described, and hepatitis has been demonstrated as a sequel to transfusion, particularly of pooled plasma. "Attention then turned to the development of a plasma volume expander. With the advent of the Korean War, investigative activities were intensified both in the combat area and in the civilian laboratory. Experience during Korea demonstrated that traumatic shock could be well treated in the young man with the skills and resuscitative tools then available (Fig. 2). Few men died in Korea of hemorrhagic shock once therapy had been instituted. Whole blood was available in adequate quantities in

the forward hospitals in that specific theatre. Albumin and dextran proved effective forward of the hospitals. Treatment of hemorrhagic shock in the young man had come a long way!" (5) "With the passage of time since 1953, research in this area again tended to lapse." (5)



FIGURE 1. Laboratory tents and laboratory truck used by the Board for the Study of the Severely Wounded in operation at Monghidoro, Italy, 1944. Some of the many problems were those associated with winter snows and spring rains. (2)

However, the increasing knowledge of the importance of shock in not only surgical conditions but also in many medical diseases, plus the tremendous surge in medical research in general and the advances in technology and instrumentation has in recent years produced an astounding amount of new knowledge in the field of shock. Of necessity most of this research was carried out in animals, particularly dogs. This was due to the tremendous and expensive resources for both patient treatment and research which must immediately be brought to bear whenever an individual is in critical shock. Usually all available resources were concentrated on the treatment of the critically ill patient, and complex studies were left till later if at all.

However, only veterinarians are really interested in shock in dogs, and it was readily apparent that dogs and humans are differ-

ent in many ways. Many attempts were made to extrapolate results from dogs to man but these were only partially successful.

In 1960, an international conference on Recent Progress and Present Problems in the Field of Shock, (5) at Walter Reed Army Institute of Research recommended that the time had come for the intensive study of shock in man. A number of centers in this country picked up this challenge and set up centers for the study of shock in man. Perhaps the pioneering shock unit was that set up at the University of Southern California. Then came other units including the one at the Walter Reed Army Medical Center.



FIGURE 2. Laboratory and shock treatment facility of the Surgical Research Team in Korea, 1952. Temporary buildings had replaced the tents of World War II. Note patients being treated for shock. Laboratory procedures were for use in patient care and for research.

The present book is the result of a study of shock and related conditions beginning in 1953 at the U. S. Army Hospital at Ft. Belvoir, Virginia, and extending continuously through the years

at the 97th General Hospital, Frankfurt, Germany, the U. S. Army Hospital, Ft. Benning, Georgia (6), and finally including studies at highly sophisticated and elaborate shock units at Walter Reed Army Medical Center and at field units in Vietnam at the 93rd Evacuation Hospital and 3rd Surgical Hospital. The practical aspects of treatment of shock under average or even adverse conditions are emphasized.

Washington, D.C.

ROBERT M. HARDAWAY, III, M.D.

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THIS BOOK IS BASED primarily on laboratory and clinical studies made by the Division of Surgery of the Walter Reed Army Institute of Research over the past seven years. These facilities are physically located in the Walter Reed Army Institute of Research and at Walter Reed General Hospital (both are parts of the Walter Reed Army Medical Center in Washington, D. C.), and at the 93rd Evacuation Hospital and 3rd Surgical Hospital in South Vietnam.

The entire staff of the Division of Surgery participated in the studies. Certain individuals were more directly involved. Not all of these participated at one time, but over the past three years they worked all or part of the time. Most individuals participated both at Walter Reed and in Vietnam.

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1st Team (Apr-Oct 1966) (93rd Evacuation Hospital): Captain John A. Collirts, MC, Chief; PVT Kent P. Boothman; PVT Mitchell C. Caldwell; PVT Robert R. Heath; PVT Stephen V. Thompson; PVT Philip H. Walker; PVT Jerry W. Wassmann.

2nd Team (Oct 1966-Apr 1967) (3rd Surgical Hospital): Captain Paul M. James, Jr., MC, Chief; Captain Carl E. Bredenberg, Jr. MC; Captain Robert W. Anderson, MC; 1LT Gene P. Phillippi, ANC; SFC Cecil Pugh, Jr.; SP5 Aaron J. Grace, Jr.; SP5 Eric A. Lundberg; SP5 Mitchell T. Elliott; PFC William P. Monahan; PVT Robert J. Fink; PVT Mitchell Caldwell.

3rd Team (Apr 1967-Nov 1967) (3rd Surgical Hospital): LTC John J. Kovaric, MC, Chief, Apr-July 67; Major Charles A. Heisterkamp, MC, Chief, July-Nov 67; Captain Richard L. Simmons, MC; Captain Jerome J. Vernick, MC; 2LT Larry D. Pritchard, ANC; SP5 Edgar A. Adjahoe; SP5 Milton R. Gnegy; SP4 J. D. McGriff; SP4 Harvey D. Patterson; PFC Gerald S. Hedmann; PFC Roger D. Brittain.

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| | — Vietnam Studies, Chapter 17 |

- Major John G. Lodmell, MC — Cardiac Aspects of Shock, Chapter 15
- Captain Carl E. Bredenberg, MC — Respiratory Support and Problems, Chapter 13
- Captain Arthur M. Martin, Jr., MC — Pathology of Clinical Shock, Chapter 18
- Captain Marlene G. Burns, ANC — Nursing Procedures and Training of Personnel, Chapter 21
- Captain Robert Lee West, MC — Blood Coagulation Studies at Walter Reed, Chapter 17
- Dr. Louise L. Phillips, Ph.D. — Fibrinolysin Studies, Chapter 17
- Dr. Kenneth H. Sleeman, Ph.D. — Enzyme Studies, Chapter 10.

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R.M.H.

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