Major Issues in Critical Care Medicine

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Major Issues in Critical Care Medicine

To our wives and children

Gale Reesman Parrillo
Nicholas Parrillo

Dolores Kobrick Ayres
Stephen, Elizabeth and Margaret Ayres

for their love and understanding. Seriously practicing critical care medicine requires a group effort.

Preface

Providing optimal medical care for the sickest patients is the ultimate goal of critical care medicine. It has long been recognized that acutely ill patients benefit from careful observation and prompt treatment of life-threatening physiological derangements. The modern critical care unit arose from an experience of clear patient benefit in the postoperative recovery room during the 1950s and the coronary care units of the 1960s. These positive experiences employing rapid diagnosis and appropriate, immediate therapy led to application of the critical care concept to many other acute life-threatening diseases and syndromes. The results of wider application of this concept have been mixed, and as the field of critical care medicine matures, certain indications for critical care have become clear while much remains to be defined and investigated. The purpose of this book is to define clearly the important issues facing critical care medicine, and to allow experts to express their viewpoints regarding the answers and appropriate future directions.

The impetus for this book arose from a National Institutes of Health Consensus Development Conference devoted to the topic of critical care medicine. As detailed in an introductory chapter by Jacoby and Crout, the purpose of these conferences is to evaluate an evolving medical technology regarding its scientific basis and appropriate application. The structure of the conference is patterned after the judiciary: a panel of "unbiased" observers (the jury) listens to a series of expert speakers "testify" regarding the present state of the art in critical care medicine. The panel then convenes and formulates answers to very pointed questions that have been posed prior to the conference. The questions for this conference were as follows:

1. Is there empirical evidence that intensive care units (ICUs) cause a decrease in patient morbidity or mortality? Which patients are most likely to benefit from intensive care?
2. What skills are essential for personnel in a critical care unit? How should this personnel be trained and organized to assure the best care for patients most in need?
3. What special technology and therapeutic interventions should be routinely available for the most effective ICU function?
4. How is a hospital's critical care delivery system best structured: one large multispecialty unit or multiple small subspecialty units?
5. How has the development of ICUs affected the traditional functions of a hospital?
6. What direction should critical care research follow?

Although this book arose from many of the issues and ideas spawned at this NIH conference, the book is not a typical "proceedings" volume. The chapters consist of manuscripts submitted after the conference by the experts (except for Chapter 28, which was written by a panelist) and contain much more information than the time allotted during the conference would allow. Thus, this book allows the experts to present much more of the scientific evidence and reasoning behind their views and positions regarding these important issues.

By attempting to answer the six questions posed above, this volume provides data and views from recognized authorities regarding our present understanding of the major issues in critical care medicine. This represents a huge undertaking. Critical care medicine has evolved into a very large field,

encompassing inputs from anesthesiology, internal medicine, pediatrics, and surgery. The chapters represent our synthesis of the most important issues that needed to be addressed. Certain topics were specifically excluded from the conference because they were deemed too large to be adequately considered; these excluded topics were pediatric intensive care and the management of burned patients. Because of space and time considerations, some issues received only limited consideration. The editors have designed the book so that it reflects (in our view) all of the major issues presently facing the field of critical care; we realize that some workers might choose to emphasize different topics.

The chapter authors of this book represent recognized experts in their area of critical care medicine; many of the authors are recognized as *the* expert in their field. As editors, we have taken this fact into consideration, and during the editing process, we have taken pains not to change the major opinions or views expressed by the authors. We felt it was very important to allow differences in viewpoint or practice to show clearly. It is interesting that, despite the differences, there is a remarkable consensus regarding the important principles in the field of critical care.

We feel this book will provide interesting and very important data regarding the present status of a highly important field of medicine. It should be of considerable interest to all observers (physicians, nurses, technicians, administrators, and health care planners) of this rapidly growing and changing subspecialty of critical care medicine.

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Introduction: Critical Care Medicine

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The newest medical "specialty," critical care medicine, practiced informally for the past 2 decades, has rapidly acquired theoretic foundations, state-of-the-art expectations, and organizational structure. Like almost all new socio-scientific enterprises, it has also become a focal point of significant controversy. Arriving on the American scene at a time of public concern over the high cost of medical technology, ethical questions over the initiation and termination of life-support measures and increasing pressure for better accountability of health professionals, it now confronts the health care system with important opportunities and vexing problems.

A historic paradigm summarizes how critical care medicine began and how it could mature or even disappear. For many years, poliomyelitis was frequently fatal because the failure to breathe was considered synonymous with the failure to survive. The introduction of the negative-pressure whole body ventilator or "iron lung" in the years following World War II saved many lives as communities acquired hardware and professional expertise. The economic problems of long-term care for ventilator-dependent patients were frequently solved by sideshow techniques with vans carrying a "man in an iron lung" traveling from town to town, charging admission to wide-eyed youngsters and adults. Parallel progress in immunology and microbiology ended the need for iron lungs as widespread immunization prevented poliomyelitis.

Extension of the iron lung concept to patients with chronic pulmonary disease, asthma, acute pulmonary edema, and respiratory failure due to increased vascular permeability—the acute respiratory distress syndrome (1)—soon led to the introduction of a group of life-support techniques that included prolonged endotracheal intubation, closed chest cardiac massage and defibrillation, continuous electrocardiographic monitoring, electrical reversal of cardiac arrhythmias and electrical pacemaking, bedside cardiac catheterization with flow-directed catheters, analysis of respiratory gases in arterial and mixed venous blood, intraaortic balloon counterpulsation, and other even more specialized procedures.

In the beginning, anesthesiologists played a leading role in the application of these high technology methods. They were in the hospital for much of each day, were skilled at intubation, and were accustomed to dealing with seriously ill patients after surgery. In fact, postoperative recovery rooms were the first intensive care units. Internists soon became involved when it was discovered that apparent death from myocardial infarction could be successfully treated by electrical defibrillation. The observation that resuscitation was possible only if a trained team of health professionals armed with endotracheal tube and defibrillator arrived on the scene within several minutes led to the emergence of the coronary care unit and institutionalized the involvement of internists in critical care medicine.

The coronary care units introduced in the 1960s revolutionized the care of hospitalized patients (2). Special observational techniques, the availability of skilled nurs-

ing care, and the regular assignment of physicians knowledgeable about the care of the extremely ill patients were necessary to reduce complications and improve survival. Technology forced the stratification of patients by severity and type of illness because expensive equipment could not be widely dispersed throughout the hospital. Such equipment was frequently too costly for general use and required special training. The direct current defibrillator was an important addition to patient care but was of little use unless immediately available. When the diagnostic value of ventricular premature contractions in patients with acute myocardial infarction was identified, the coronary care unit with continuous electrocardiographic monitoring, resuscitation equipment including defibrillators, and specially trained personnel became necessary. Amazing as the new technology appeared to be, the changes in utilization of health manpower were even more earth-shattering. Registered nurses were suddenly propelled into the forefront of coronary care since physicians were frequently not available on a 24-hour basis in many hospitals. They made electrocardiographic observations, diagnosed the specific types of cardiac arrhythmias, and prescribed electrical therapy, frequently in the total absence of physician support. A new era arrived as physicians delegated major diagnostic and decision-making responsibility to well-trained nonphysicians.

Coronary care units reduced mortality from acute myocardial infarction and tremendously improved the treatment of cardiac arrhythmias. They became a prototype of intensive care *limited* to a specific problem. While patients rarely died from electrical problems, however, some died from ventricular failure, forcing the cardiologist to acquire new skills as limited cardiac care became more generalized and included care of other failing physiologic systems. Patients with acute pulmonary edema were intubated and hemodynamic measurements with bedside catheterization techniques were made in patients with shock (3). Perhaps the most significant change was the routine use and interpretation of arterial blood respiratory gas analysis to determine the level of pulmonary veno-arterial shunting and adequacy of alveolar ventilation. The acute respiratory care unit was born and chest physicians joined cardiologists in the application of new technology to old clinical problems.

The once secure belief that the problems experienced by the patient of an organ specialist would remain conveniently limited to that organ was further shaken by a study of the Division of Lung Diseases of the National Institutes of Health (4). Analyzing 490 patients considered for extracorporeal membrane oxygenation, it was noted that overall mortality was 40% in the one-third who had respiratory failure alone. In the remaining patients, mortality was related to the status of other organ systems. Mortality rates were 85% in the 162 patients with renal failure, 79% in the 143 with central nervous system involvement, and 77% in the 116 with sepsis. The number of additional organs involved, not the organ itself, appeared to determine mortality, so that involvement of one additional organ led to 55% mortality, three to 85%, and four additional to 100%. Had traditional deployment of medical specialists been followed, many patients would have required at least five subspecialists in addition to their primary physician.

Similar experiences have been reported in other studies (5, 6), emphasizing the need for comprehensively trained generalists able to deal with the simultaneous or sequential malfunction of multiple organ systems. Early signs of organ malfunction such as declining oxygen tension and rising creatinine, bilirubin or fibrin split products in apparently stable patients may herald disaster but are frequently ignored. While precise knowledge of etiology may permit early application of specific corrective action, an expanding experience suggests that analysis of physiologic abnormalities provides a parallel and sometimes more predictive indicator of ultimate outcome. Cumulative scoring of physiologic abnormalities in the first few hours of care generates a predictive

index that could be used to determine optimal treatment and allocation of scarce resources (7).

The long-held clinical belief that a relatively stable "golden" period is often interposed between the inciting event and subsequent deterioration has been confirmed by careful investigation. A group of primary etiologic factors seems to produce diffuse vascular injury with sluggish regional blood flow and leakage of plasma contents into interstitial spaces (8). Animal models suggest that early treatment may prevent multiple organ failure and help expand the concept of critical care medicine to include on-site stabilization, safe transport to hospital and immediate care in emergency room and intensive care unit.

Early recognition of life-threatening illness has become a major challenge for the medical community (9). At the moment, the advance of technology appears to have outdistanced the available human resources; better ways must be found for the recruitment, training, and organization of the people necessary to master this new technology. Medical care is traditionally delivered by office-based primary care physicians or organ-focused specialists who spend a relatively small portion of their time in the hospital. While organ-oriented medical or surgical specialists perform superbly in situations involving their own areas of expertise, bedside care frequently becomes suboptimal when an unmanageable group of consultants attempts to forge a cohesive plan of action. Training and continued experience in the *comprehensive* care of critically ill patients with emphasis on total function rather than a more parochial concern for organ protectionism appear essential.

An attempt to define the boundaries of critical care medicine by examination and prescribed training has recently been developed by the American Board of Medical Specialties. In 1980, the American Boards of Internal Medicine, Anesthesiology, Surgery, and Pediatrics joined together to offer a certificate of special competence in critical care medicine. Of novel design, the same examination will be given to all applicants—internists, surgeons, anesthesiologists, and pediatricians. One well-trained intensivist at the bedside might replace several organ specialists.

A number of perplexing systems problems demand early solution! The most adequately trained individual is of little use to the critically ill patient unless he is available almost immediately. The staffing of emergency rooms and critical care units in the thousands of small hospitals that provide most first-contact care in the United States is of great concern. At the very least, a physician with broad training, able to intubate and initiate vascular monitoring, should be on the premises in any hospital receiving ambulance patients.

The socio-political uncertainties that have hindered the optimal organization of human resources for the care of the critically ill have also had impact on other aspects of the health care system. Philosophers, politicians, ethicists and other designers of public policy have had great difficulty in deciding whether health care is a right or a luxury. Many shrink from orderly consideration of the allocation of scarce and expensive resources, but certain vexing questions must be faced. Should all individuals, for example, have access to the critical care system even though a growing body of data (10) suggests that some are too sick to benefit from that level of care while others may not be sick enough?

National concern over a health budget greater than 10% of the gross national product has intensified at the same time that high technology promises to return certain patients with heretofore hopeless illness to useful lives. Prospective medicine, legislation designed to reduce the growth of hospital costs, could have a major impact on the practice of critical care medicine. Reimbursement in this system is based on some 470 diagnostic groupings with little attention paid to severity or functional status. All patients with acute myocardial infarction, for example, will be reimbursed at the same level of payment regardless of whether 10 or 300 g of tissue are infarcted!

The system appears to have worked relatively well in those few states where it has been introduced, but careful attention to the outcome of critical illness under this approach to medical reimbursement is obviously essential.

Comprehensive critical care, an idea born in the high technology that emerged following the Second World War, reflects the important shift from medical art to medical science that has marked the latter part of this century. Representing a concentration of sustaining resources gathered together where they can be most useful, it is a concept rather than a specialty. Many can understand the value of early and rapid correction of disordered physiology; only those with training, continuing experience, and availability should attempt to practice those concepts at the bedside.

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SECTION SIX

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