

COMPLICATIONS IN CRITICAL CARE MEDICINE

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Complications in Critical Care Medicine

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Foreword

During the past two decades, the entire field of critical care medicine has become recognized as an exceedingly important subject throughout this country and the world. This text, edited by two leading authorities in the field, is extremely well written and deserving of high praise. First, it is a very comprehensive text, and in addition, a product of acknowledged leaders. The opening chapter entitled "Critical Care—Dilemmas" was written by Christopher W. Bryan-Brown, a master in this field who also has a remarkable capacity to write in both an effective and superb manner. It opens with the terse quote from George Bernard Shaw: "Do not try to live forever. You will not succeed." At the outset of this important chapter, the author directly faces the issue of reduction of fiscal resources in this country and abroad and the necessity to make difficult choices in the management of the severely ill. The concept that the medical establishment is responsible for the preservation of life at all costs, even in hopeless situations, is fully addressed. This is particularly meaningful in view of the recent decision of the Joint Commission on Accreditation of Hospitals to add this component to each hospital's review in the future with a statement of their position on this issue. This is of obvious significance in view of the economic implications as well as the wishes of the patient and the family. The author is also keenly aware of the medicolegal implications of decisions relative to limitations of the prolongation of life of patients with a hopeless illness. As the legal profession continues to find fault

and provide evidence that compensation is due patients for a poor medical outcome, this magnifies even further this vexing situation. Moreover, it is emphasized that the tort system has become a multibillion dollar industry, with plaintiffs receiving only 20% of the premiums paid by physicians for liability insurance. Of the some 50,000 critical care beds in hospitals throughout the United States today, it is estimated that their use exceeds their need, in that hopelessly ill patients occupy a number of these beds with little long-term justification. In addition, some beds are being occupied as a convenience to the patient rather than as a necessity. Thus, the scoring system as advocated by Cullen is emphasized for its practical usefulness. Patients with scores in the range of 40 had a very high mortality and were experiencing multisystem failure, whereas those with scores of approximately 12 did not require the facilities of an intensive care unit. The chapter ends with a wise statement, "The solutions should become more apparent if the needs of the critically ill patient, rather than those of physicians and society, are kept uppermost."

The chapter, "Complications of Mechanical Ventilation," a subject of ever-increasing importance, is very well written and thoroughly updated. One of the unique features of this text is the highly useful "Editor's Comment" at the end of each chapter. For example, Philip D. Lumb comments at the end of this chapter: "The critical care directors and all personnel involved with the selection and purchase of new ventilatory devices should be

fully familiar with the capability and safety features of all available equipment." Following are excellent chapters on complications from the use of pulmonary artery catheters, with emphasis on the high rate and the need to remove such catheters as soon as is medically feasible. The entire field of shock is extraordinarily well covered with separate sections on complications of pharmacotherapy of shock, complications of septic shock, and the physiologic management of acute renal failure. In the latter chapter, attention is focused on close monitoring of renal function with stress on early diagnosis to maximize preservation of appropriate function.

Bollinger and Knechtle have provided a very comprehensive chapter, "Complications of Organ Transplantation," discussing a field that is rapidly enlarging in all centers with a concomitant increase in the numbers of problems, despite the overall improvement in both patient and transplant survival. The complications of cardiac surgery are well described by a highly knowledgeable cardiac surgeon, Stephen A. Mills, and include the most recent advances in this ever-expanding field. Few aspects of critical care are of more importance than nutritional requirements of the critically ill. Again, this section is admirably reviewed by an authority, John P. Grant, in a very practical way allowing direct application of the data to the clinical situation. The important subject of design and construction of the intensive care unit is also very thoughtfully reviewed with many practical suggestions.

The final chapter is an intriguing one and concerns the impact of changes in health care finance on critical care medicine. It is written by Duncan Yaggy, an acknowledged authority in the field. Problems associated with Medicare and Medicaid and a review of the DRGs

together with their impact are carefully evaluated. The mounting issue of competition among insurance plans, HMOs, and preferred provider organization are each thoroughly reviewed. In the Editor's Comments at the end, emphasis is placed on the fact that many of the feared changes under the DRG system have not occurred, and in many instances hospitals are showing an improved fiscal posture since introduction of this plan. Nevertheless, the inherent inequalities and inadequacies are emphasized. Lumb concludes, "It would appear that all physician practitioners, and especially those in critical care services, become adept at being patient advocates not only in the manners in which treatment is provided, but also in the ways in which treatments are documented, justified, and publicized." This is obviously of maximal importance and will undoubtedly increase in its significance in the future.

In summary, *Complications in Critical Care Medicine* is a master work, thoroughly updating the entire field, and providing instructive as well as provocative reviews of all the important aspects of care of the critically ill. It will quite predictably be well received by all those involved in this field, and it can be stated with confidence that this text is a *must* for all involved in critical care medicine as well as a necessity in every such unit. The editors, and their carefully selected contributors, should be congratulated on such a very timely, effective, and comprehensive work.

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Foreword

This book is targeted at the important issues of *complications* in critical care medicine. However, as is frequently observed in Medicine, the systematic appreciation, documentation and study of clinical “complications” becomes the *raison d'être* for this rapidly progressing subspecialty.

We have learned at Duke University Medical Center that patient care is strengthened considerably by the stimulating questions and dialogue that come from the melding of multiple disciplines. Similarly, this synergy is evidenced by the union of this country's extraordinary expertise in critical care medicine by the book's co-editors. Drs. Philip D. Lumb and Christopher W. Bryan-Brown have skillfully prepared a volume that should prove essential to those interested in the basis of the practice of critical care medicine. Each of the authors selected for this text presents an independent, keen perspective and, importantly, *clinical opinion* on a carefully selected

and timely topic. Accompanying each chapter is a useful editorial commentary that provides refreshing insight and continuity serving to bond the entire work together.

The reader of this book will quickly appreciate the uncommon attention to editorial detail that can only be achieved by clinical scholars, and the sincere enthusiasm with which the co-editors and authors enhance their medical specialty. Because I have long enjoyed the benefits of collegial interactions with the contributors to this new publication, I am personally honored to acknowledge the advances in our understanding of critical care medicine presented herein.

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Preface

Critical care medicine has always been associated with an aggressive, technologically oriented brand of medicine with apparently short-term goals. Although practitioners support the concept of restoring a patient to his/her former state of health, the measurements and successes in the field have involved far less permanent goals. Reversal of shock or restoration of oxygenation are viewed as improvements secondary to therapy. Yet, the failure of these successes to alter significantly overall mortality for patients with temporally similar illnesses over the past decade must be regarded with suspicion. There is a suggestion that the patient population has aged over this period and that if overall mortality was compared with indices of patient illness, then the statistics may be more favorable. However, this argument appears similar to others that have swelled critical care publications and have led to a "statistical" approach to critical patient care.

On the other hand, arguments could be made that the very sophistication that apparently surrounds patient care actually has created the above conundrum, i.e., is critical care practice worth the effort and cost? Multiple authors have critiqued previous studies on the basis of statistical analysis or a reworking of physiologic formulae to prove a new, different point. Additionally, flaws in measurement techniques and interpretations, differences in patient classifications, and varying nursing and physician skills make patient outcome comparisons difficult in an area of medicine with a paucity of generally accepted

standards. In fact, the standards generated have evolved from the flawed studies that created the controversy in the first place.

Interspersed throughout all publications in critical care medicine are those regarding specific complications associated with the therapies or with the technology associated with patient monitoring or care delivery. For the most part, these complications have been accepted as a necessary evil that derives from the provision of excellent care. True, multiple attempts have been made to decrease complications, but always the question of cost/benefit ratio for a certain treatment has been hidden in the short-term gratification rather than overall survival. Recently, comments that question the life-saving potential of either pulmonary artery catheterization or intermittent mandatory ventilation have been voiced. In 1983, a National Institutes of Health consensus panel agreed that critical care medicine was beneficial; however, this agreement was tinged by the comment that only in coronary care units where dysrhythmia monitoring and prophylaxis were practiced could mortality be shown to have decreased significantly. All other agreement within the panel was intuitive rather than deductive, and the questions posed by this nonanswer or nonagreement shake critical care practice to its foundations. In fact, it is possible that the current lack of progress in critical care medicine as reflected by static mortality rates will become a self-fulfilling legacy because critical care practice in individual institutions is variable and no overall standards have been for-

mulated. Indeed, lack of specificity in diagnosis make inter- and intrainstitutional comparison of results with the same or similar diagnosis difficult, and a meaningful data base is hard to obtain.

Complications in Critical Care Medicine attempts to highlight some of the controversial areas in patient care and to present them with reference to their impact on patient care. Therefore, although pulmonary artery catheterization may not be associated with decreased mortality in some ICU populations statistically, is this due more to a lack of appropriate information utilization rather than an inherent failure of the technique? Certainly, this attitude could be supported by recent evidence that tends to support the concept that aggressive preoperative monitoring decreases the incidence of postoperative myocardial infarction in at risk noncardiac surgical

patients. Additionally, all critical care practitioners are familiar with the intensive care unit consult, which is politely accepted and therapeutically ignored. Would outcome be different if we truly practiced at the current levels of technology, physiology, and data gathering?

Certainly, this textbook is not designed to answer these questions. Rather, it is intended to pose a different look at critical care practice and raise the question of whether or not critical care medicine has been able to change the way patient care is delivered in a fundamental sense, versus the idea that the changes are merely technologic window dressing that looks good on television but does little to promote effective patient care? Hopefully, the answer is not as bleak as the question.

PHILIP D. LUMB, M.B., B.S.

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CHAPTER 1

Critical Care—Dilemmas

CHRISTOPHER W. BRYAN-BROWN, B.M., B.Ch., F.F.A.R.C.S.

Do not try to live forever. You will not succeed.
GEORGE BERNARD SHAW (1911)
(Preface to *The Doctor's Dilemma*)

Critical care has become well developed during the last 20 years, with well-established specialists and well-recognized national and international journals and societies. The management of the patient who is acutely ill engenders high emotion, both within the health care delivery sphere and in society at large. This chapter discusses some of the dilemmas involving this high-mortality group of patients and their care. Because the United States has had more resources available to medicine than anywhere else, there has been a state of *l'embarras des richesses*. Now the resources are being cut back; the choices are even harder, and the decisions more difficult to justify; so many of the problems have taken on a greater prominence in this country than elsewhere.

MORTALITY

In 1978 Sir Macfarlane Burnet suggested that a society with unlimited technical resources and money was always in a position to prolong life for a little while. Such a country has been the United States. It is likely that the dying process in the United States has been prolonged for as much as four years for

those in old age. Conversely, in Norway not only do people survive longer, but there is generally a much shorter period between the development of the degenerative incapacity that precludes independent living and death—about one year. For a decade the heads of the various US government agencies that support health programs for the elderly (Medicare and Medicaid) have been perturbed at the ever increasing drain of funds used to pay for medical care in the last year of life. With the availability of technology and resources, over half of some budgets are used up on a very expensive form of terminal care. At the same time as Americans wish to have the costs of health care delivery stemmed for others, few would wish changes in their personal arrangements for medical care.¹ Ideally, if savings could be made on costly but useless therapy, then more money could be spent on other social programs. This could provide the indirect medical benefit of a healthier populace and, therefore, an opportunity to redirect medical resources to more productive areas. While it is easy to be sympathetic with such laudable sentiments, and whereas rational and humane reduction of this therapeutic overkill might have been possible, hopes for any reasonable solutions have been dashed by reactionary legislators with “Baby Doe” laws and legal judgments. These have been used

to coerce health care providers to channel their resources (which have at last been found to be limited) into the care of those who give a poor return for the investment—financially, philosophically, and physically; frequently this is done against the wishes of family and friends, those with the patient's welfare most at heart. The fear that social convenience will overtake humanism is not ungrounded, with the memory of the ruthless policies of the German government administration during the 1930s and early 1940s.² It was but a short step to euthanasia, another short step to determining the right to life for chronic invalids and the insane, and then another short step to mass medical murder of those considered inconvenient to care for or politically undesirable. One of the prices that society may demand of the medical establishment is the security of having all life preserved, even to the extent of providing full critical care in hopeless situations. There is the hope this would help prevent another slide down the slippery slope from surfeit to disdainful arrogance to disaster ("from *koros* to *hubris* to *ate*") for which there is so much historical precedent.³

There is a legal fiction that medical decisions should be made by physicians. Unfortunately for most physicians, their medical decisions may have to stand the inquisition of law courts⁴ and be justified to a jury of laymen. To paraphrase Talleyrand—medicine is much too serious a thing to leave to physicians. Attack is possible not only from unsatisfied patients, but also from governmental departments and public-interest groups. Somehow because of life-sustaining expertise and technology, critical care has found itself in the middle.

The legal profession is trying to find fault, or at least to show cause why damages are needed to recompense patients for a poor outcome. The financial ability for many patients to sue is so limited that the contingency basis (considered unethical by most bar associations outside the United States) has been touted as an enabling solution. Unfortunately, the system has now backfired, doing much to make

a farce of the judicial system and putting too much of a premium on the size of awards. The tort system has become a multibillion dollar industry, with wronged plaintiffs receiving only 20% of the premiums paid by physicians for liability insurance. Many physicians are running scared and become more interested in keeping clear of the legal problems than the basic needs of their patients.

Legislation and governmental departments translating legislation into regulations, sometimes based on private agendas, are insisting that certain groups of patients are being cared for at levels unrealistic for their prognoses.⁵ At the same time the legislators, who wish full critical care services for all who might need ventilatory assistance, are limiting budgets and setting up agencies (often inappropriately expensive to run) to deny additional expenditure on the critically ill. Hospital administrators now want care designed to hold down costs. The right way is becoming the least expensive way, and any expense designed to better the human side of a patient's situation may not be reimbursed. This pragmatic approach to health care delivery, where financial efficiency is promoted to the detriment of moral and ethical values, is but the Hegelian point of view espoused so devastatingly by National Socialism in the 1930s.

The technical success of critical care has fostered the ever more popular "living will," which is receiving ever greater legal sanction. Death with dignity is the quest, and one that is popularized by a Hollywood type of romanticism of the dying process. Some of the lawmakers seem to have been envisaging the terminal cancer patient as the model for someone who should have the right to opt out of a distasteful and futile experience while dying. The choice should be the patient's or some worthy surrogate's (unless the patient has legal "protection" from some federal legislation), and he is also allowed to opt for a chance of a miracle. Miracles are rare; however, in the initial stages of most acute illness, so is the critical care physician's ability to foretell imminent death. There seems little

difficulty left for recognizing brain death as a reason to stop medical care. The patient popularly and ethically is being considered socially dead, even if some signs of life persist. While brain death is by and large an issue of the past, the vegetative patient with no chance of ever again becoming a conscient being is a problem of the present.

Permanently comatose patients often require ventilator support, tube feeding, hemodialysis, and also extensive legal manipulations and judicial orders to be considered socially dead. A salutary turn of events may turn out to be the development of institutional ethics committees, which can bring all parties together to try and develop a rational consensus on what is appropriate care for a given patient. The medical ethicists, the most recent of specialists, are thriving on trying to rationalize different levels of care. Some clinicians feel threatened by others taking over what has traditionally been their prerogative. But, these new players on the health care delivery team offer the hope that more of these difficult decisions will not revert to medicine, and "terminal weaning"⁶ will not be a euphemism.

ALLOCATION

"Allocating" resources is more politically acceptable than rationing them, merely because the former is usually some form of grand plan, whereas the latter affects the needy individual directly. If there are no intensive care units in a community, that is unfortunate for those in need. If there are critical care facilities available to a community, then it is unfair if those who could gain most benefit from them are not given the opportunity to use them.^{7, 8} In the United Kingdom, elderly patients developing renal failure may not have dialysis available to them, which is an allocation that does not sit well with an aging electorate or the medical establishment.⁹

It is probable that the United States has a surfeit of critical care beds of about 6% of total hospital beds or over 50,000. Estimates of

how many patients there are who would really gain from the use of those beds are harder to come by, but probably by no means are there as many as there are available beds. In other words, supply exceeds need. This leads to critical care being given to patients who will not benefit from it. Before prospective payment plans were brought into play, this was financially a good thing for hospitals, as patients in the intensive care unit (ICU) generated revenue by their heavy utilization of laboratory and diagnostic technical services. While ICU beds were budgeted for at two to three times the average hospital bed cost, they were very profitable. An indication of the overutilization of critical care facilities is one of the conclusions (not the authors') that could be drawn from a study by Strauss et al.¹⁰ They noted that when the demand for ICU beds was high, patients had shorter stays in the ICU and were more ill. There was no significant change in overall mortality and morbidity or length of hospital stay. Obviously, at times, sicker patients were getting ward care, and this may have involved some additional work for the physicians and nurses. However, this also means that this lower level of care was sufficient.¹¹ Also, the costs were probably less for the patients.

If the ICUs of the United States are being used as a convenience for looking after patients who—for reasons good or bad—do not need critical care, is there a disadvantage? The ones who are too well lighten the load so that other sicker patients can get more care or staffing ratios can be kept lower (nurse per number of patients). When the availability of ICU beds goes down, the units tend to admit just the sicker patients. Usually there is not an immediate increase in the nurse-patient ratio, so the work load is increased; overtime is demanded, and the level of critical care nursing frustration rises. The patients who are too far along in their diseases to benefit from critical care are hard work to look after and do not give rise to job satisfaction. Perhaps this is why a large part of the qualified work force has left the practice of critical care nurs-

ing.¹² Some units gain a poor reputation and experience difficulty in recruiting. This leads to understaffing and the added danger of patients being seriously jeopardized because their needs are not met.^{8, 9} It is almost impossible to discharge a patient with a slim chance of survival from an intensive care unit to make room for one whose chances of survival would really be improved by admission. Priority of place tends to remain tantamount, particularly if both patients have some chance of survival. The desire to design a method of finding nothing but appropriate patients to treat (i.e., patients with a reasonable prognosis to return to a reasonable quality of life) will continue to gnaw at the vitals of critical care and probably should as long as there is a cost problem.¹²⁻¹⁴

PROGNOSIS

At some point in our lives, we will be in a condition that precludes further long-term survival; death is our destiny. If this condition is recognizable, then critical care becomes futile and possibly an inhumane exercise. The capricious irreversibility of shock has been a puzzlement to critical care investigators, so much so that "irreversible shock" has at times been treated as a diagnosis. The theory is simple—a sufficient shortage of oxygen utilization will upset metabolism irreparably, and the organism will go on to die.¹⁵ The quantification of lethal oxygen debt is possible in controlled circumstances but difficult in the clinical setting. Once the lethal damage has been done, cell function may return temporarily.¹⁶ During this phase, terminal physiologic mechanisms are being studied. Originally lactate data looked very valuable,¹⁷ but basically only predicted the outcome in patients with an obviously very severe circulatory failure.

Three main approaches have been used to try and define survivors, nonsurvivors, and those likely to have a poor outcome and thereby rationalize the use of critical care resources.

The first approach has been to classify patients according to the disease load they are carrying. The sicker and more feeble they are, the more likely they are to die. This type of classification also gives some numerical idea of the patient load in terms of illness rather than the patient census. It is therefore useful in determining staffing needs as well as the capability of a unit to take more patients. The Therapeutic Intervention Scoring System (TISS) was introduced by Cullen et al. in 1973.¹⁸ The amount of critical care the patient received was quantified by giving a value of 1-4 for all therapeutic interventions. Acute hemodialysis was typical of a "4," and ECG monitoring typical of a "1." Patients with scores around 40 had a very high mortality and were experiencing multisystem failure, whereas those with scores of around 12 did not need to be in an intensive care unit. While TISS was a highly original and well-verified system, it was difficult for some to accept because of the statistically sound corollary that the more that is done for a patient, the more likely he is to die! It, of course, did not predict which individual would die but what his chances of dying were.

Civetta¹⁹ tried a more statistical method. Systems failures and specific incidents were each given a numerical weight, based on how often they were independently associated with death. These values were then subtracted from a number to produce a score. Each year of life was valued at 0.25, renal failure, sepsis, and gastrointestinal hemorrhage were all worse than respiratory failure. A fluid resuscitation was added to the total rather than subtracted and so on. He found that all the patients who had less than a certain score died, and all that had above another score lived. An elderly patient might start with a score of -20 for age, so could not afford many systems in failure. The group with intermediate scores (some lived, some died) made up 75% of the total, and only 5% were in the group in which "all died," so that there are no great savings to be made by this technique. The difficulty in applying these scores