PREDICTION OF SURVIVAL IN THE CRITICALLY ILL ICU PATIENT

Essay

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INTRODUCTION

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An age old aphorism states that. if you know every thing that is important about a disease, then, you should be able to predict its outcome. and if you can predict its outcome, then, you should be able to modify it (Shoemaker, et al., 1984).

The intensive care units are designed to treat patients who need facilities and services which are not available in general hospital wards. Such patients are usually admitted with insufficiency or failure of one or more of their vital organs. Thus, they need continuous monitoring, and appropriate therapeutic measures to support the failing systems. This is only possible if performed by skilled nursing staff supervised by experienced doctors (Dobb, 1984).

Science of prediction is viewed as a necessary step in the maturation of intensive care for the following main reasons: First, to treat individual patients more precisely, ensuring that they receive all the necessary treatment but avoiding futile care. Second, to do a better job of comparing the performance and quality of intensive care units and thereby increasing their effectiveness. A third reason is that, patients, physicians and society have become increasingly concerned over the economic, social and personal aspects of current medical care and in particular critical care practice. A fourth reason is that, each day, critical care physicians have to decide, which patients to admit to their ICUs?, and how vigorously to treat them?. The patient is considered an appropriate candidate for ICU admission if his illness was deemed too severe for care in a routine hospital area (death could be predicted), and the illness was likely to respond to treatment in the ICU. The patient is excluded, if his illness was so severe that death was likely even after treatment in the ICU or if the patient is likely to survive even if deprived of the benefits of the ICU. Such decisions are in large part based on outcome prediction.

All the previously mentioned factors have encouraged investigators to try to improve the ability to predict the outcome for critically ill patients who are admitted and treated in ICUs (Zimmerman and Knaus, 1989).

Our essay has the following objectives. First, to discuss the pathophysiology of critical illness, focusing on the common factors involved in the pathogenesis of multiple organ failure syndrome which often represents the pre-terminal phase in the course of critical illnesses and which can be prevented in many instances by proper understanding of these factors, together with, meticulous attention and care given to the patient during the course of any critical illness. Second, to discuss determinants of survival of critically ill patients which include patient-related factors (type and severity of disease, physiologic reserve and response to therapy) and treatment-related factors (type, timing and process of therapy). These factors were engaged in different scoring systems which evaluate and predict the outcome of critically ill patients on the base of clinical status and laboratory findings. Thus, our third objective, is to mention these scoring systems that predict the outcome for critically ill ICU patient and how to use them.

PATHOPHYSIOLOGY OF CRITICAL ILLNESS

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Organ systems often, but not always, fail in a sequential pattern in critically ill patients. Failure of an organ that has not been or can no longer be corrected may affect other organs and set up a cycle of failing organs - a physiologic domino effect. To prevent this multiple organ failure, one must identify the factors that contribute to organ failure including those specific for single organs and those common to all organs, so that, they may be prevented or if that is not possible, corrected promptly (Berk, 1982).

Thus, pathophysiology, pathogenesis and prevention of multiple organ failure syndrome which often occurs late in the course of critical illnesses making survival unlikely, will occupy our focus on discussing the pathophysiology of critical illnesses. Also, since, the pathophysiology of the adult respiratory distress syndrome (ARDS) is the best studied example to the pathophysiologic processes underlying multiple organ failure syndrome, it will be discussed in details.

ORGAN - SYSTEM FAILURE (OSF)

Knaus, et al., (1985) tried to put definitions for organ system failure (OSF) based on the presence of severe physiologic derangements, avoiding the inclusion of any therapeutic modalities except the dependence of the patient on the ventilator after the initial three days in the ICU. These definitions are applied to each 24-hour period while the patient is receiving life support therapy directed at correcting his abnormal physiology. The patient is defined to have multiple organ system failure if two or more organ systems met failure criteria, whether organ failures occurred simultaneously or successively.

Wilkinson, et al., (1986) tried to put criteria for (OSF) in children and infants based on the presence of extreme physiologic abnormalities, extremely abnormal laboratory values or the use of life- support therapies that could ameliorate or eliminate the physiologic or laboratory abnormalities.

Table 1. Definitions of Organ - System Failure (OSF)

If the patient had one or more of the following during a 24-hour period (regardless of other values), OSF existed on that day. (Knaus, et al. 1985).

I. Cardiovascular failure (presence of one or more of the following):

A. Heart rate <= 54/min.

B. Mean arterial blood pressure <= 49 mm Hg (6.45 K Pa).

C. Occurrence of ventricular tachycardia and/or ventricular fibrillation.

D. Serum pH <= 7.24 with a $PaCO_2$ of <= 49 mm Hg (6.45 K Pa).

II. Respiratory failure (presence of one or more of the following):

A. Respiratory rate <= 5/min. or >= 49/min.

B. $PaCO_2$ >= 50 mm Hg (6.59 K Pa).

C. $A-aDO_2$ >= 350 mm Hg (46 K Pa), $A-aDO_2 = 713\ FIO_2 - PaCO_2 - PaO_2$.

D. Dependence on ventilator on the fourth day of OSF, i.e. not applicable to the initial 72 h of OSF.

III. Renal Failure (presence of one or more of the following):

A. Urine output <= 479 ml/24 h or <= 159 ml/8 h.

B. Serum BUN >= 100 mg/100 ml.

C. Serum creatinine >= 3.5 mg/100 ml.

IV. Hematologic failure (presence of one or more of the following):

A. WBC <= 1000 / mm^3.

B. Platelets <= 20,000 / mm^3.

C. Hematocrit <= 20%.

V. Neurologic failure:

- Glasgow Coma Score <= 6 (in absence of sedation at any one point in day).

- Glasgow Coma Score:

Sum of best eye opening, best verbal, and best motor responses. Scoring of responses as follows: (Points)

A. Eye - open

. Spontaneously	(4)
. To verbal command	(3)
. To pain	(2)
. No response	(1)

B. Motor

. Obeys verbal command	(6)
. Response to painful stimuli	
- Localizes pain	(5)
- Flexion - Withdrawal	(4)
- Decorticate rigidity (Flexion)	(3)
- Decerebrate rigidity (Extension)	(2)
- No response	(1)
. Movement without any control	(4)

C. Verbal

. Oriented and converses	(5)
. Disoriented and converses	(4)
. Inappropriate words	(3)
. Incomprehensible sounds	(2)
. No response	(1)

- If intubated, use clinical judgment for verbal response as follows:

  . Patient generally unresponsive (1)

  . Patient's ability to converse is in question (3)

  . Patient appears able to converse (5)

- If the patient is paralyzed or sedated, neurologic scoring is not performed and the patient is not considered in neurologic failure