

# The exciting adventure of Intensive Care Medicine

## Where did we begin, where are we now, where are we heading?

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### ABSTRACT

The origins of Intensive Care Medicine can be traced back to Copenhagen, Denmark in 1952 during a poliomyelitis epidemic. During the next 40 years, there was a remarkable advance in Intensive Care Medicine which led it to be widely established as a new medical specialty. Nowadays, Intensive Care Units (ICUs) are independent departments with advanced technological equipment that provide continuous monitoring and support of vital signs for all critically ill patients. There is a global trend for an increase in the number of ICU beds, while at the same time Intensive Care Units already carry a huge economic burden. At the beginning of the new millennium, Intensive Care Medicine has to face new challenges. There is a need for new therapeutic criteria and improvement of the quality of care for the rapidly aging population of advanced countries and a growing need to address the moral dilemmas regarding end-of-life decisions. *Pneumon 2016, 29(3):211-215.*

*Change is the process by which the future invades our lives.*

Alvin Toffler, 1928-2016,  
American writer and futurist

## A. THE RISE OF A NEW MEDICAL SPECIALTY

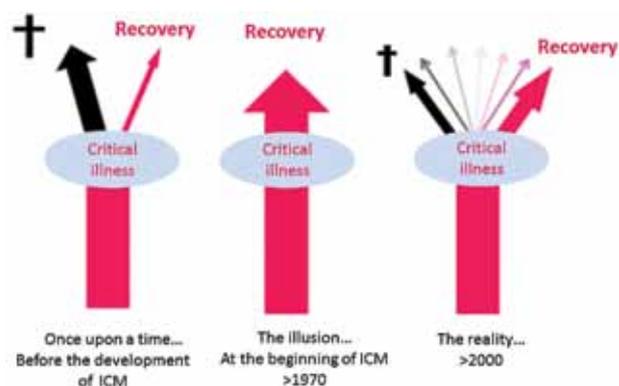
The origins of Intensive Care Medicine can be traced back to Copenhagen, Denmark, where approximately 60 years ago a poliomyelitis epidemic caused respiratory paralysis and carried a mortality rate that reached 85-90%. In August 1953, B. Ibsen, widely considered as the founder of Intensive Care Medicine, implemented positive pressure ventilation via a tracheostomy tube. It was Ibsen himself that proposed the idea of gathering all these patients in a single department, and assigning a nurse responsible for the care to each patient. Within a few weeks, the mortality rate of poliomyelitis

patients with acute respiratory failure had fallen below 40%. This phenomenal success was to give rise to a new medical specialty<sup>1</sup>. What followed was just as fascinating. Blood gas analysis was made feasible with the wide availability of special electrodes for measuring pH, pCO<sub>2</sub> and pO<sub>2</sub><sup>2</sup>. ABG analysis along with the introduction of physiotherapy notably improved the outcomes of those patients that needed support with prolonged mechanical ventilation. The importance of a multidisciplinary approach for the care of critically ill patients was made clear from the early years of Intensive Care. The first Shock Unit (a mere four-bed department) was founded in Los Angeles in the early 60s under M. Weil<sup>3</sup>. Acute Respiratory Distress Syndrome (ARDS) was initially described in an article published in *Lancet* in 1967. This syndrome would prove to be the epitome of the concept of acute respiratory failure that warrants treatment in an Intensive Care Unit (ICU)<sup>4</sup>. Research in the 70s led to a deeper understanding of the pathophysiology of critical care illness and the development of new technology that extensively enhanced the monitoring and support of vital functions of critically ill patients. The advances made in these core concepts of Intensive Care achieved significant improvement in the outcome of these patients. APACHE II, introduced in 1985, boosted clinical research since it was widely adopted as the main tool in evaluating the severity of critical illness<sup>5</sup>. During the 90s, the importance of ICUs in the practice of modern hospital medicine was widely acknowledged and they were universally established as independent departments. By that time, Intensive Care Medicine had officially become recognized as a new medical specialty. Soon enough, there were new journals, textbooks, conferences and diplomas all addressing the needs of Intensive Care Medicine.

## B. MATURATION, ESTABLISHMENT AND SELF-CRITICISM

At the beginning of the new millennium, Intensive Care Medicine was already sufficiently mature to devise innovative practices for the treatment of clinical illness and new methods of assessing the quality and effectiveness of provided care using the cumulative knowledge gained from basic and clinical research. At the same time, however, it became obvious that the notion that immediate, successful resuscitation was enough to secure a good outcome was a misconception (Fig. 1).

The fact that several of the methods and techniques



**FIGURE 1.** Before the development of Intensive Care Medicine, critical illness would most often lead to death. For a long time after the beginning of Intensive Care Medicine, there was a widespread illusion that any critical illness could be cured. As time went by, we came to realize the limits of Intensive Care Medicine.

applied in Intensive Care Medicine were invasive was considered as one of its major shortcomings right from the outset. Many were of unproven efficacy, as shown by subsequent relevant studies, while others resulted in several complications that increased iatrogenic morbidity. Numerous randomized, high-quality studies with large cohorts conducted during the first decade of the new millennium were to reveal several important findings. High tidal volumes correlated with increased mortality among patients with mechanical ventilation<sup>6</sup>. The routine use of pulmonary arterial catheters was associated with many complications and failed to change the outcome<sup>7</sup>. Transfusions of blood were inappropriate, if not harmful, when the target involved hemoglobin levels of more than 10gr/dl since there was no additional benefit when compared to the target of 7-9 gr/dl<sup>8</sup>. Prolonged sedation was linked to a worse outcome<sup>9</sup>. Readjusting the practices of Intensive Care based on those studies significantly improved the outcome of critically ill patients. Furthermore, published guidelines concerning several important aspects of Intensive Care, such as sepsis, transfusions and nutrition, led to a global spread of accurate, established knowledge regarding the care of such patients<sup>10-12</sup>.

Throughout the years, great progress has been made with regard to technological equipment, design, and the internal organization of Intensive Care units. In terms of technological equipment, the modern ICU seems a lot different from the ICUs of the recent past. The respirators are smaller, portable, fully digital and have touch screens, rendering them more user-friendly. They allow

exceptional synchronization with the patient's respiratory efforts, thus significantly reducing the need for sedation. We now have portable ultrasound units and further non-invasive techniques that permit easier and more accurate monitoring of hemodynamic and other physiological parameters. The pulmonary arterial catheter (Swan Ganz), once regarded as one of the most recognized symbols of Intensive Care, is now increasingly seen as outdated. The design of modern ICUs is the result of international research that sought to address changing structural and functional needs. The implemented changes were cost-effective and resulted in better outcomes as well as improved quality of care.

The vast, growing knowledge and experience gained during these decades brought about significant changes regarding the practice of Intensive Care Medicine which led to the standardization of clinical practice. The implementation of clinical protocols, checklists and care bundles resulted in fewer mistakes, improved productivity and better quality of care<sup>15,16</sup>. Nowadays, ICUs are staffed by intensivists, specially trained nurses, physiotherapists, and technicians, all working closely together with other health professionals such as clinical microbiologists and pharmacists. This multidisciplinary approach has essentially turned the care of critically ill patients into a team effort. Great emphasis has been placed on the systematic recording and monitoring of indicators concerning the quality of care (e.g. mortality rates, length of ICU stay, duration of mechanical ventilation, infection rates) and the assessment of patient, family, and ICU staff satisfaction<sup>17,18</sup>.

The quality of communication with the patients and their families has improved considerably since the early years of Intensive Care Medicine. Intensive Care Units used to be isolated and inaccessible, and the time allowed for family visits was very limited. Nowadays, family members are allowed to spend much more time with the patient. The ICU staff also devotes more time informing and updating the patient and family; this communication is now far more meaningful. The paternalistic model of practicing medicine is no longer favored, as the principles of respect toward the patient's autonomy and shared decision-making have gained wide acceptance. Extensive progress has been made regarding the issue of end-of-life decisions; an ongoing effort is being made to achieve international consensus on such fundamental issues<sup>19</sup>.

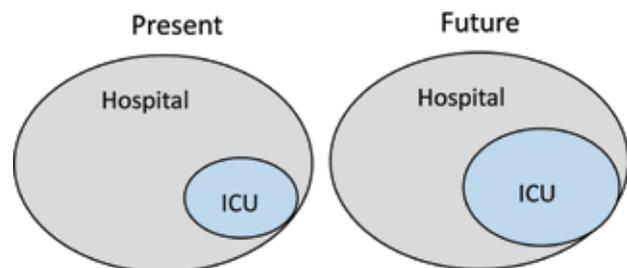
These changes have incited the growth of ICUs throughout the world. There is little in the modern ICU to remind us of the first Units founded in "heroic times".

### C. FUTURE PROJECTIONS - ACCEPTING THE LIMITS

Some of the predictions regarding the future of Intensive Care Medicine actually seem realistic:

1. The remarkable developments made in technology and informatics will dramatically improve means of monitoring and support of critically ill patients and also revolutionize the working and nursing environment of ICUs. The option to monitor the patient, ask for diagnostic tests and give commands regarding therapy from mobile devices with the use of networks is already a reality and foreshadows a future that now seems miraculous.
2. Advances in molecular biology are expected to lead us to a better understanding of the pathophysiology of several clinical syndromes that cause critical illness such as sepsis and ARDS. This would allow us to achieve a more personalized approach toward the critically ill patient, a faster and more accurate diagnosis, and a far more effective treatment.
3. The differences between Emergency Medicine and Intensive Care Medicine will probably become less clear. The potential of an immediate diagnosis and resuscitation might lead to the merger of Emergency Departments and ICUs<sup>20</sup>.

The number of ICU beds tends to be on the increase internationally<sup>21</sup> (Fig. 2). This trend reflects not only the growing needs for intensive care, but also the greater expectations of both physicians and society itself. This growth is also related to pressures from the health care market and the physician's tendency to immediately adopt all new technologic achievements<sup>22</sup>. A patient is ever more likely to be admitted to an ICU, a decision which is often made without considering the prognosis. This has raised serious concerns regarding moral issues and financial consequences.



**FIGURE 2.** In our time, there is an obvious global trend for a continuous increase in ICU beds. Some have even gone too far and claim that future hospitals will look more like a large ICU!

## The great challenges

Intensive Care Medicine carries a huge economic burden. For example, the annual cost of Intensive Care in the United States increased from 56.6 billion to 81.7 billion dollars in the period from 2000 to 2005. This represents 13.4% of the total cost for hospitals, 4.1% of total health care costs and 0.66% of the GDP<sup>23</sup>. Although the remuneration of ICU staff constitutes the greatest part of these costs, appointing intensivists to work exclusively for the ICU and having them lead a multidisciplinary team has been shown to reduce overall costs and improve outcomes. Telemedicine and redistribution of ICUs also seem to be cost-effective. The concept of regionalization in the process of redistribution calls for large ICUs that will serve the needs of entire health districts and has been shown to reduce costs and offer better outcomes<sup>24</sup>.

One of the greatest challenges that Intensive Care Medicine will have to face in the immediate future is the growing need to attract adequately trained staff to meet the increasing demand for ICU beds. This may not be a simple task since there seems to be a lack of people willing to accept the relatively harsh ICU work environment and comparatively increased mortality rates, not to mention the huge prevalence of burnout syndrome and low financial motivation<sup>25</sup>.

However, the greatest challenge of all seems to be the growing age of the population that inevitably increases the need for Intensive Care. Nowadays, the majority of critically ill patients suffer from more than one disease and certainly from more than the direct cause of critical illness itself. They generally present serious chronic health problems related to their advanced age that will have a significant impact on prognosis. This is a relatively new problem for Intensive Care Medicine. It has become increasingly more difficult to determine the prognosis for each patient, even with the use of clinical prognostic tools designed to estimate the severity of clinical illness<sup>26</sup>. At the same time, the mounting expectations of patients, families, and even physicians practicing other medical specialties, result in an ever-growing demand for more ICU beds. Such changes carry serious financial consequences and raise several moral issues, especially with regard to end-of-life decisions. In our opinion, this is how we can face these challenges:

1. There needs to be an increase in the number of Intermediate Care Units. The timely transfer of high-risk patients to an Intermediate Care Unit could improve outcomes and result in fewer complications, shorter

length of hospital stay and less nursing cost<sup>27,28</sup>. An Intermediate Care Unit would also provide a more humane environment for the patients and their families and facilitate, among others, the decision-making process for end-of-life dilemmas.

2. An outreach team, including both ICU doctors and nurses working outside the ICU and within the hospital, could help to promptly detect those patients that may require Intensive Care and solve problems for others recently discharged from an ICU. This would improve outcomes and also facilitate communication with the patients and families, as well as any decisions regarding further treatment options.
3. New doctors need to be properly trained to acquire better communication skills and become adequately equipped to openly address issues regarding treatment choices for an aged patient and especially end-of-life decisions<sup>26</sup>.

## D. CONCLUSION

The evolution of Intensive Care Medicine from the heroic times of immediate resuscitation 60 years ago to the modern times of complicated, sophisticated care of critically ill patients in an environment of high technology has been nothing less than a fascinating journey. Our initial excitement has been replaced by realism and circumspection. Nowadays, Intensive Care Medicine is a medical specialty that is called upon to urgently face fundamental challenges that affect everyday clinical practice and relate with the limits of medicine, the concept of respect for human dignity and the rational distribution of available assets.

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