Daniel Agustín Godoy

INTENSIVE CARE IN NEUROLOGY AND NEUROSURGERY

Pathophysiological Basis for the Management of Acute Cerebral Injury

VOLUME 1

SEEd

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To my parents Mirtha and Justino
for giving me the life, education
and the opportunity to study and
acquire this wonderful profession.

To my kids, Facundo, Luciano, Josefina
and Alvaro who have suffered my absences
and for all the love given me every day.

To Veronica, my love, my friend,
my support, guidance, and
containment with whom if God
willing I share what I have left.

To all my colleagues and friends who
have shared with me over than 23 years
of hard and tireless work, uncertainties,
anxieties, sorrows and joys in the Intensive
Care Units where I have worked.

To the life...

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Prologue

This book deserves to my gratitude, more than my prologue.
Many years ago, when this project started, its aim was simple: to provide the physician with a quick and practical tool for consultation. However, the enormous generosity, selflessness and spirit of collaboration of great teachers and world opinion leaders in this subspecialty made it possible to transform it in what it is today.
Some time ago (I still remember well his e-mail), Prof. Stephan Mayer of Columbia, New York, in that period President of the Neurocritical Care Society, described the book as "magnum opus". In my humble opinion this definition was very exaggerated, but his words were like a shot of optimism that undoubtedly lead the way. My teachers and friends encouraged me, helped me, I held back, and therefore they all have my eternal gratitude. In particular, I'd like to mention two persons who had a great role in my professional life, with whom I shared most of my professional life, two great friends: Esteban Piacenza, who taught me how to take my first steps in intensive care, and Prof. Walter Nigri, neurosurgeon, who introduced me into the neurocritical care.
Of course it was not so easy. Editing a book of this magnitude is a Herculean task, only understandable by those who have done something similar. In addition, during its preparation I had to overcome a rough and long illness (and this is the reason for its delay). However, like everything one undertakes in life, it has a special flavor when the effort needed has been intense. So I'd like to recommend to potential readers two sentences that accompanied me throughout my life, especially during difficult periods and obviously while editing this book: «Persistence is the key to success» and «What's to come is better».
Simply thanks to all those who made possible to make this dream come true.

Daniel Agustín Godoy

Preface

«During revolutions scientists see new and different things when looking with familiar instruments in places they have looked before. It is rather as if the professional community had been suddenly transported to another planet where familiar objects are seen in a different light…» [1]
Thomas S. Kuhn

This volume, which we have the honor to introduce, presents the work of a group of international experts in neurocritical care. Dr. Daniel Godoy has completed thedaunting task of introducing the beginner and updating the specialist on current knowledge in brain injury. Anyone who has been involved in editorial projects will have experienced the trials and tribulations of uniting the efforts of many; Dr. Godoy's book is no exception. He has met this challenge patiently and tenaciously. Having known him for many years, we feel he is to be commended for his devotion and drive. His extraordinary interest in science has made him a well-known expert his field bringing about an ever-increasing level of activity in neurointensive care in Argentina.
Many of the contributors to this book are known personally to us, colleagues with different specialties who we also consider friends, having come together through a shared fascination with an undoubtedly complex and heterogeneous medical challenge: neurocritical care.
This book is dedicated to brain-injured and neurocritically ill patients. The management of these patients constitutes a growing subspecialty that remains unrecognized by many international medical associations but has played a prominent role in intensive care over the last two decades.
Neurocritical care as a subspecialty evolved from the need to provide highly specialized care to neurosurgical patients. Later, patients with severe traumatic brain injury (TBI), hemorrhagic stroke, and acute central nervous system disorders were included in this line of care. Each of these patients requires specialists who are knowledgeable of their particular clinical situations in addition to rapid and often complex management of intracranial hypertension, technical equipment, and skilled nurses [2]. Indeed, specialized nursing forms the backbone of modern neurocritical care units.
As with the management of other complex pathologies (e.g. neurovascular disorders, endoscopic surgery, skull base fractures, and pediatric neurology), subspecialization in neurosurgery is essential to improving outcome and reducing complications.
In neurosurgery, outcome is always improved when the patient is in the hands of an expert instead of a general, though versatile, neurosurgeon. However, some sectors of the

international intensive care societies still view neurocritical care subspecialization with skepticism, if not with mistrust. In our opinion, these attitudes reflect irrational fears and are at odds with scientific evidence in support of subspecialization. Several studies have shown that neurocritical care specialization reduces mortality, improves functional outcome in almost all diseases studied, and is cost-effective for the health care system [3]. This has been demonstrated in patients with severe TBI, spontaneous subarachnoid hemorrhage, intracerebral hematoma, and ischemic stroke [3-5]. Admittedly, in some cases it is not easy to discern whether the determinants of improved results are the specialized units themselves or the well-structured clinical management protocols. In patients with severe TBI, the rigorous application of the Brain Trauma Foundation guidelines has been shown to significantly reduce mortality [6]. What should be remembered, however, is that such protocols have been created using procedures designed by neurocritical care specialists. What has brought added value to subspecialization most is the human factor, as noted by Smith: "Members of a multidisciplinary team who care regularly for patients with acute brain injury are more likely to be aware of the adverse impact on the brain of secondary physiological insults and to be more obsessional about their prevention, recognition and treatment" [2].

Despite contradictions, doubts, and disagreements, neurointensive care has reached organizational levels unthinkable just a decade ago and neurointensive care units can now be found in nearly all countries. Nonetheless, the tempo of change varies and the models are diverse. The Neurocritical Care Society in the United States and the Canadian Neurocritical Care Society were founded in 2003 [3]. The European Society of Intensive Care Medicine has also established a neurointensive care section, the Neuro-Intensive Care and Emergency Medicine Section. Access to specialized accreditation is homogeneous, however, following several models and using methods of access, while in other countries no models have been implemented at all.

In our opinion, and contrary to popular belief, a well-planned subspecialization based on competencies as well as generic and specific skills will not restrict but rather widen the viewpoint of the specialist and add value to the care of neurocritically injured patients. This provides a driving force for translational research, an indispensable tool in the 21st century that increases knowledge and improves mid-term therapeutic strategies and prognosis. Translational research, which is promoted by the US National Institutes of Health (http://commonfund.nih.gov), is only feasible with a therapeutic approach using multidisciplinary teams with different perspectives and methodologies to obtain a comprehensive understanding of these patients. This allows new therapeutic strategies to move from bench to bedside and back again. To be successful, this kind of research requires teams to work in an atmosphere that fosters collegial effort among neurointensivists, neurosurgeons, and neurologists with a vocation for research in collaboration with basic researchers. This ideal scenario is only possible within the context of neurocritical care units. Who should lead these units would be a side issue were it not for contentious debate in some countries and in certain scientific societies. We feel that intensive care experts are the most qualified professionals to lead these groups and facilitate the collaboration of different specialists with the common goal of improving prognosis in neurocritically ill patients.

The many research projects carried out during the Decade of the Brain (1990-2000) have produced an enormous wealth of information, and our ability to understand the underlying pathophysiology of many of the conditions affecting TBI patients is challenged, even for our colleagues in neurocritical care. These rapid advances in neuroscience over the past 20 years have led to difficulties in filtering, reading, understanding, and assimilating the latest findings. One of the great advantages of this book is that it may serve both those wishing to enter the field of neurocritical care and specialists seeking a time-

ly update. This volume originated in Latin America, where health systems are heterogeneous and free universal health coverage is not yet a constitutional right in some countries. It is therefore important to underscore that specialization in neurocritical care is only valid in certain socio-economic contexts where health care priorities are well defined. What is desirable in certain circumstances may not be so in others. The adequate context for subspecialization is perhaps more typical in developed countries, with high-tech hospitals or academic organizations that provide incentives for the management and maintenance of high-cost units. In such settings, treatment should be optimal and auditable, and serve as a guide for the design and validation of intervention protocols at other centers with fewer resources.

It is a great honor for us to introduce readers to a work that will leave a significant mark on Latin American and international neurointensive care thanks to Dr. Godoy's commendable effort to make an English version available. It is important that a project of this scale come from Latin America because it serves as a proof t ofthe enthusiasm for this subspecialization, which has been solidly established in that part of the world over the past 15 years.

New generations of intensivists, neurosurgeons, neurologists, and anesthesiologists are facing new challenges. Perhaps the most difficult challenge is to modify the collective consciousness with the idea that the optimal management of brain-injured patients cannot be carried out without a multidisciplinary approach. This is currently not being taught during specialized training, nor is it accepted elsewhere in different scientific fields, where specialists perpetuate a sterile debate about their identities and delineate characteristics that divide rather than unite them.

We believe we are witnessing what Kuhn called a "paradigm shift" or a turning point in neurocritical care. Kuhn also noted that such changes are almost never brought about by new findings but rather by the synthesis and critical review of what is already known. Frequently, it is the observer's point of view, not the observed fact, that changes. Some evident examples in pathophysiology include cortical spreading depression described by Leão in 1944, basic concepts of brain edema first described by Klatzo in 1967, and the pathophysiology of cerebral vasospasm in spontaneous subarachnoid hemorrhage, all of which were far too summarily debated for decades. In the last five years, these three areas, to name just a few, have seen dramatic advancement in terms of knowledge about the mechanisms of brain injury that had long been elusive. Improved understanding has come about by re-examining long-cherished concepts through the use of new monitoring tools and methods in molecular biology. This increased knowledge opens new therapeutic expectations, an idea best summarized by Pang et al: "the application of what we know will have a greater impact on health and illness than any new drug or technology to be introduced in the next decade" [7].

Dr. Godoy has edited a volume that will serve as a starting point rather than a final goal, opening new inroads and stimulating the interest of readers in search of knowledge. We believe that the breadth of the topics covered, the careful selection of the authors, and the quality of each section will meet if not exceed expectations.

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