Co-existing Diseases and Neuroanesthesia

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Nidhi Gupta
Editors

Foreword by
Luzius A. Steiner

Springer

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Dedicated to my parents, teachers, and my family—Pallavi, Anavi, and Amyra

Hemanshu Prabhakar

Dedicated to my parents SBL Singhal and Usha Singhal, who taught me the value of hard work and sincerity; to the parents I lawfully got—Sarbjeet Singh and Charanjeet Kaur—for their continuous inspiration in whatever I did; to my soul mate Sarabpreet for his unquestionable support and motivation; and to my lovely daughter Jasmine, who's the one I live for!

Vasudha Singhal

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Nidhi Gupta

Foreword

One of the fascinating aspects of neuroanesthesia is the fact that this specialty is alive, changing, and progressing. Many years ago while still a resident, I had the opportunity to attend a lecture by Professor Adrian Gelb, one of the pioneers of neuroanesthesia. One of the messages that he already delivered at that time was that neuroanesthesia is not only the field providing anesthesia for neurosurgical and neuroradiological interventions but also the subspecialty providing safe anesthesia for vulnerable brains. Over the last two decades, our understanding that the brain is not completely isolated from the rest of the body by an almost impenetrable blood-brain barrier but is very much affected by systemic pathophysiology has developed enormously. Today, general intensivists as well as neuroanesthesiologists and neurointensivists are increasingly aware of the fundamental interdependence of systemic and cerebral pathophysiology. They adapt their management accordingly to ensure the best possible outcome for the large number of patients with vulnerable brains we care for. Currently, a strong mission to further enlarge the scope of topics that is covered by our specialty is being led by neuroanesthesia societies. In 2017, Dr. George Mashour, president of the Society for Neuroscience in Anesthesiology and Critical Care (SNACC), presented the concept of the three pillars of neuroanesthesia including not only the traditional anesthesiological care of neurosurgical patients but also the foundational neuroscience of anesthesiology and in my view most importantly neurologic outcomes of non-neurosurgical procedures. Particularly, this third pillar represents a very ambitious but logical expansion of our field.

Despite these exciting developments driven by our specialty itself, the field of neuroanesthesia is currently going through an intriguing development. On the one hand, neuroanesthesia is diligently working toward becoming a broadly accepted subspecialty, and accordingly, some centers have introduced or will introduce fellowships in neuroanesthesia. This is already the case for other well-established subspecialties, such as cardiac anesthesia, and underscores the message that neuroanesthesia is a specialty that needs supplementary training beyond the scope of standard training in general anesthesiology. On the other hand, many neurosurgical procedures are no longer only performed in large neurosurgical centers but increasingly in smaller hospitals or even on an outpatient basis. This confronts a rising number of anesthesiologists without extensive training in neuroanesthesiology with challenges particular to our field.

This new book edited by Prof. Hemanshu Prabhakar, Dr. Vasudha Singhal, and Dr. Nidhi Gupta is one answer to this dichotomy. Professor Hemanshu Prabhakar is to be congratulated for assembling this group of renowned authors from all over the world to cover the manifold and complex topic of neuroanesthesia and co-existing disease. Both experienced neuroanesthesiologists and the occasional neuroanesthesiologist will need the provided information when confronted with the ever increasing number of patients who have relevant comorbidities or changed systemic physiology. A profound understanding not only of cerebral pathophysiology but also of the complete medical situation of any patient is key to our goal to protect the vulnerable brain during the perioperative period. Many years of clinical experience have been condensed into this book, and it will certainly help the reader to better achieve the goals of modern neuroanesthesia.

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Preface

Over years the practice of neuroanesthesia has evolved from the application of general anesthesia to neurosurgical patients to formulation of specific neuroanesthetic techniques and principles suitable for this patient population. Today, we are able to conduct neurosurgical cases with unprecedented ease and safety, thereby contributing to improved outcomes for patients with a myriad of neurosurgical ailments. However, as our techniques refine and our in-depth knowledge of cerebral pathophysiology increases, our challenges are also increasing exponentially, with more and more ASA III and ASA IV patients coming for neurosurgical interventions.

Neuroanesthesiologists worldwide are perplexed with ideal/optimal management of neurosurgical patients having comorbid conditions ranging from coexistent hypertension and diabetes mellitus, to patients with complex conditions like intracranial bleed in a patient with end-stage renal failure or patients with a recent liver transplant. Furthermore, the effects of concomitant pharmacological therapy have serious implications in neurosurgical patients such as in patients with intracardiac stents, receiving dual antiplatelet therapy. Moreover, unlike other surgical procedures, the preoperative optimization phase of these patients is short in view of the urgent or emergent nature of neurosurgical interventions.

Hence, not just the knowledge of neuroanesthetic techniques, it is imperative for us to understand the effect of altered cerebral physiology on the already compromised systemic homeostasis as well as the effects of concomitant polypharmacy on our perioperative management and vice versa. We felt the lacunae in the existing literature regarding the ideal perioperative management of such cases and thus came with this unique textbook providing the detailed description of the "*anesthetic management of neurosurgical patients with comorbid conditions.*"

This book will provide an insight into all possible aspects of perioperative management of neurosurgical and neurologic patients with comorbid conditions. It covers all the coexistent systemic comorbidities affecting organ systems like cardiac, respiratory, endocrinal, renal, and coagulation problems. It also includes chapters on the less discussed topics like neuroanesthesia in patients with genetic problems and transplanted organs.

We are grateful to all our authors from across the globe for sharing their experience and knowledge on the relevant topics. We sincerely hope that this book would obviate the necessity of referring to multiple books that at best provides only fragmented information. This book would, undoubtedly, be a great asset for the

occasional as well as experienced practicing neuroanesthesiologists. We sincerely hope this book will improve our existing knowledge about anesthetic management in patients with compromised cerebral and systemic physiology, providing us facts and realistic goals, to help improve the outcomes of these precarious patients with vulnerable brains.

New Delhi, India — Nidhi Gupta
Gurugram, India — Vasudha Singhal
New Delhi, India — Hemanshu Prabhakar

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About the Editors

Hemanshu Prabhakar is a professor at the Department of Neuroanesthesiology and Critical Care at the All India Institute of Medical Sciences (AIIMS), New Delhi, India. He received his training in neuroanesthesia and completed his PhD in the same institute. He is the first Indian to be awarded the degree of PhD in the country. He is a recipient of the AIIMS Excellence Award for his notable contribution to academia and has published over 200 papers in peer-reviewed national and international journals. Dr. Prabhakar is a reviewer for various national and international journals and is also a review author for the Cochrane Collaboration. He has a special interest in evidence-based practice of neuroanesthesia. Dr. Prabhakar is a member of various national and international neuroanesthesia societies and is past secretary of the Indian Society of Neuroanesthesia and Critical Care. He is an invited scholar for various national and international conferences. He is on the editorial board of the *Indian Journal of Palliative Care* and is the executive editor of the *Journal of Neuroanaesthesiology and Critical Care*. He is the first Indian to publish international books in the specialty of neuroanesthesia.

Vasudha Singhal, MD graduated from the King George's Medical University, Lucknow (U.P.), and underwent neuroanesthesia and neurocritical care training in the prestigious All India Institute of Medical Sciences, New Delhi, India. She is currently working as a Senior Consultant in the Department of Neuroanesthesiology and Critical Care in Medanta, the Medicity, Gurgaon, one of the leading neurosciences center in the country. She has published various papers in respected national and international journals and is the leading author of a number of book chapters. She received the coveted Dr. A.N. Jha and Dr. K.P. Chansoriya medal for the best oral presentation at the ISA (Indian Society of Anaesthesiology) national conference in 2005. She has delivered lectures at various national conferences and is actively involved in neuroanesthesia and neurocritical care training across the country. Dr. Singhal is an executive committee member of the Indian Society of Neuroanaesthesia & Critical Care (ISNACC) and is a reviewer for *the Indian Journal of Anesthesia* (IJA) as well as the *Journal of Neuroanaesthesiology and Critical Care* (JNACC).

Nidhi Gupta is an associate professor and consultant in the Department of Neuroanesthesia at the Indraprastha Apollo Hospital, New Delhi, India. She completed her D.M Neuroanesthesiology at the All India Institute of Medical Sciences, New Delhi. She was awarded the honorary adjunct title of "Associate Professor" by the Apollo Hospitals Educational and Research Foundation for her contribution to academia and research. She is also the recipient of "Best Paper" award at the Indian Society of Neuroanesthesia and Critical Care (ISNACC) Conference in 2013. She has numerous publications in peer-reviewed national and international journals and book chapters related to neuroanesthesia to her name. Dr. Nidhi is also a reviewer for the *Indian Journal of Anaesthesia* and the *Journal of Neuroanaesthesiology and Critical Care*. She is a permanent member of the ISNACC and an invited scholar for various national conferences.

Introduction

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Vasudha Singhal, Charu Mahajan,
and Hemanshu Prabhakar

Neuroanesthesiology, as a branch, has been rapidly diversifying with the recent advancements in neurosurgical practices, anesthetic drugs, and neuromonitoring techniques, leading to better clinical outcomes. Evolution of neurosurgical expertise poses new challenges for the neuroanesthesiologist. The emphasis, however, still remains on a basic understanding of the disease process, and a thorough preoperative evaluation and optimization of patients prior to surgery, so as to provide a rapid, high-quality recovery.

A comprehensive understanding of the coexisting diseases in a patient who presents for a brain surgery is of paramount importance, in order to plan anesthesia appropriately and ensure optimal operating conditions for the surgeon, thereby ensuring a smooth recovery and good patient outcome. In elective surgery, the patient can be adequately investigated and optimized prior to surgery. In emergency scenarios, the anesthetic technique can be planned in a way that would have minimal bearing of the coexisting disease on the neurological outcome of the patient.

The patients presenting for neurosurgery usually have varied issues, ranging from hypertension, diabetes mellitus, kidney disease, chronic obstructive pulmonary disease (COPD), and hypothyroidism. Patients with liver disease and associated coagulation derangements may present with intracranial bleeds that may need decompression. Patients with coronary artery disease, on dual antiplatelets, presenting with ischemic or hemorrhagic stroke, are a common scenario in routine clinical practice. A pregnant female admitted with acute hydrocephalus from a concurrent intracranial tumor, warranting a ventriculoperitoneal shunt, may not be uncommon in tertiary care centers. What is expected from a neuroanesthesiologist in all such patients is a detailed knowledge of the coexisting disease, its manifestations,

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