Essentials of Regional Anesthesia

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For my wife of over 20 years, Kim Kaye, MD,
for her patience, love, and wisdom
in raising our two wonderful children,
Aaron and Rachel.

Alan David Kaye

To my mentors, students, and trainees
for their inspiration, and to my parents,
Dennis and Tanya, and my wife,
Zina Matlyuk-Urman, MD.

Richard D. Urman

I dedicate this book to my parents,
my husband Muthu, my sons Gopal
and Vijay, and all my colleagues and friends
for their constant encouragement.

Nalini Vadivelu

Foreword

The editors of *Essentials of Regional Anesthesia* have asked me to write a Foreword for the book. Their request is most likely due to my involvement in regional anesthesia and its growth in the last 40 years. I have written and published on regional anesthesia extensively during this period, and this opportunity allows me to reflect on the progress regional anesthesia has made since its inception in 1884.

Regional anesthesia came to the European medical scene with a bang, when Carl Koller experimented with cocaine for its use in eye surgery and presented the data of his experiments to the Ophthalmological Congress in Heidelberg in September, 1884. His findings were accepted readily by the surgeons, since they were having significant morbidity and mortality with Ether and Chloroform. During the ensuing years up to 1930, regional anesthesia was commonly practiced safely, both in Europe and North America. New techniques such as spinal block, epidural block and peripheral nerve block were developed during this period. The limitation of performing regional anesthesia was that there was no training program for any physician who wished to learn this practice. It was done on an ad hoc basis by the assistants to the surgeons and the nurses.

As the specialty of anesthesia started in 1933, the anesthesiologists preferred general anesthesia to regional anesthesia because general anesthesia was easier to learn. The scientific growth in monitoring and safety in anesthesia practice was the main reason for popularization of anesthesia techniques.

All the same, Mayo Clinic in 1930s and 1940s still did their major surgeries with spinal anesthesia or peripheral nerve blocks with intravenous sedation by a barbiturate. Gaston Labat worked at this institution and became very accomplished in regional anesthesia. He wrote the first book on the subject – *Regional Anesthesia: Its Technique and Clinical Application* – which even today is a seminal book for practitioners of regional anesthesia. He was uniquely responsible for forming a society called the "American Society of Regional Anesthesia" (ASRA) for interested regional anesthesia physicians. The society's deliberations and activities are well documented in the Wood Library Museum. ASRA started to wither with future scientific growth in general anesthesia, such as the introduction of Halothane, intravenous induction of anesthesia with a barbiturate, and the discovery of muscle

relaxants like Curare. This allowed the anesthesiologist to easily monitor the level of anesthesia necessary for surgery and not have the patient kept awake. Surgeons loved this change in anesthesia practice.

During the 1970s, anesthesia training was overwhelmingly for general anesthesia practice, and the instances in which physicians used regional anesthesia techniques were few and far between. In spite of this state of affairs, giant figures like John Bonica, Philip Bromage, Alon Winnie, Daniel Moore, and Donald Bridenbaugh fought hard to advocate for the practice of regional anesthesia for surgical, obstetric, or cancer pain patients. They were the teachers of regional anesthesia and started the training programs in their departments. This culminated in the revival of the American Society of Regional Anesthesia. The residents going into the anesthesia specialty loved to learn about regional anesthesia, and with their support, regional anesthesia practice flourished. ASRA created practical workshops and educational programs, and with their influence the society was able to spread its wings in Europe, Asia, and Latin America.

During the period 1975–2010, remarkable scientific advances were made in the techniques, local anesthetics, and devices that assist in the success of regional anesthesia. In the 1980s, the peripheral nerve stimulator was an advance in locating nerves, and in the last few years, assistance by ultrasound techniques was introduced. Both of these techniques have been well received by the practitioners of regional anesthesia. Many books and documentaries are now available for training the physician in regional anesthesia.

Alan David Kaye has provided me with the reason why this book was conceived. He explains it is for the clinicians, students, residents, fellows, and attendees to learn and train in the new technology of regional anesthesia practice. He has mostly chosen authors who are Directors of the Regional Anesthesia Fellowship programs; this provides a sound basis on which the trainee can get the most up-to-date information on the state of practice of regional anesthesia.

The book is divided into six sections, including general considerations, basic science and clinical practice, equipment, and the modern practice of regional anesthesia. There are 31 chapters most of the chapters are formatted consistently, such as (a) anatomy of the block (b) indications for the block (c) types of techniques available (d) clinical pearls (e) complications. The chapters commonly end with multiple-choice questions.

I find *Essentials of Regional Anesthesia* very well organized and timely and that it fills the void created by rapidly changing regional anesthesia practices. Even though there are many books available on regional anesthesia, the incorporation of ultrasound for each block is a unique feature of this book and will be well received by the trainees. I recommend this book for all libraries of anesthesia departments, including for training of residents and medical students.

Lubbock, TX, USA P. Prithvi Raj

Preface

The practice of regional anesthesia has undergone tremendous evolution in the past few decades. Until recently, older blind techniques were taught, and successful regional anesthetics were typically limited to a few extraordinary clinicians in each department of anesthesia worldwide. Ultrasound, electrical stimulation, fluoroscopy, and continuous catheters have contributed to a revolution in the fields of regional anesthesia and pain management. Advances in technology have changed these fields significantly, resulting in the development of formal regional anesthesia and pain fellowships.

The present field of regional anesthesia has challenged not only new residents and fellows but also older practicing anesthesiologists to learn these new techniques and technologies in their clinical practices. Excellence and versatility in regional anesthesia can provide the means by which we better manage acute and chronic pain. Modern regional anesthesia provides hope and optimism for the comfort of future generations of patients afflicted with a wide array of medical conditions.

One of the strategies in creating a book on *Essentials of Regional Anesthesia* was to make it practical for the clinician. To that end, we have recruited regional anesthesia fellowship directors and their fellows as authors for most of the chapters in this book. We also requested that authors identify clinical pearls and help us create a databank of questions for trainees to facilitate learning of the subject material. The editors of the book agree that this has been a challenging but rewarding project. Since this is a first edition, we have endeavored to present the material with clarity and conciseness. Our goal has been a book of practical applicability for the anesthesia provider. Best of luck to each of you as you develop your clinical practices in regional anesthesia.

New Orleans, LA, USA — Alan David Kaye
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Part I
General Principles of Regional Anesthesia Practice

1

General Considerations for Regional Anesthesia Practice

Edward R. Mariano • Karley J. Mariano

Contents

Introduction

Setting up a regional anesthesia service requires a reliable and consistent product as well as a sound business plan. Technological advances in nerve stimulation, ultrasound guidance, and perineural catheters have led to rapid growth in the number and types of peripheral nerve block procedures available to regional anesthesia

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practitioners. Starting a new regional anesthesia program potentially adds monetary value to a facility's perioperative services by improving the quality of postoperative analgesia and recovery from surgery, thereby reducing perioperative costs and offering a competitive advantage over other surgical facilities. From the patient's perspective, a regional anesthesia program provides nonmonetary value by preventing pain and reducing the risk of nausea and vomiting after surgery. Unfortunately for anesthesiologists interested in starting a new regional anesthesia program, there are no evidence-based guidelines to follow.

While the argument in favor of developing a regional anesthesia program in terms of nonmonetary value is convincing, determining monetary value is vital to initiating any new program. There are start-up costs to consider, and expected revenues are typically delayed. How does the individual anesthesiologist convince his or her own anesthesiology group or hospital administrators that a new service that provides peripheral nerve blocks and acute pain management is worth the investment? In this era of cost-effective health-care delivery, all medical institutions, academic and private, are under similar financial pressures. For academic centers, the primary educational mission must be achieved in the setting of financial stability.

Reasons for Starting a Regional Anesthesia Program

As the definition of "outpatient" surgery continues to broaden, patients previously hospitalized for the same surgeries several years ago are now scheduled for discharge on the day of surgery. Lengthy hospitalizations for some major surgeries are gradually progressing to overnight admission. For example, total joint replacement postoperative protocols have been refined to the point that it is currently feasible to practice same-day discharge or short-stay admission for appropriate cases [1–3].

The causes of prolonged recovery after scheduled ambulatory surgery have been studied and are multifactorial. In addition to type of surgery, these factors include postoperative nausea and vomiting, as well as pain following general anesthesia [4]. The proper application of regional anesthesia techniques in the ambulatory setting can minimize or avoid these common side effects and decrease the time required for patients to meet predetermined discharge criteria [5–7].

According to the results of a survey conducted by Dr. Macario and colleagues, nausea, vomiting, and pain are among the main side effects patients prefer to avoid after anesthesia [8]. It is increasingly important to consider patient preferences in the current health care system. Ensuring high patient satisfaction will likely lead a patient to return to a particular health care system for future surgical services and potentially result in new referrals. Patients should be considered consumers with the right to the highest quality service, and they have choices regarding their health care. Anesthesiology groups or hospitals who offer regional anesthesia services can employ marketing strategies to outcompete other anesthesiology groups and hospitals that do not offer similar services.

Regional anesthesia is not "one size fits all" anesthesia. The combination of specific peripheral nerve block techniques can produce anesthesia and postoperative analgesia that is nearly as selective as the surgical procedure itself. In a large case series, Klein and colleagues have demonstrated that peripheral nerve blocks in the ambulatory setting lead to reductions in perioperative intravenous opioid use and high patient satisfaction and can be used in conjunction with oral opioid analgesics [9]. For the nonorthopedic patient, other regional anesthesia techniques may offer similar advantages [10–12].

In order to extend the duration of site-specific pain relief beyond the immediate perioperative period, continuous peripheral nerve blocks (CPNB) and perineural local anesthetic infusions are currently used for a wide variety of surgeries in the ambulatory environment [13–20]. Randomized, placebo-controlled studies have conclusively demonstrated significant reductions in patient-reported pain after shoulder, foot, and distal upper extremity surgery as a result of CPNB [18–21]. By providing superior analgesia at home, CPNB effectively reduces the need to hospitalize patients for pain control. Broader application of these advanced regional anesthesia techniques has contributed to the growing interest in ambulatory total joint replacement [1, 2, 22, 23].

Bringing Your "Product" to Market

Developing a new regional anesthesia program is like inventing a new product. In addition to ensuring the consistency and reliability of the product, the prospective clientele and demand for the product should be considered. Applying this analogy, it is essential to identify potential customers and their needs. The *patient* and *patient's family* are the most important customers, and improvements in the overall quality of postoperative recovery resulting from regional anesthesia offer meaningful benefits to them. S*urgeons* are clearly important customers to any anesthesiology practice, hospital, or surgical center. Surgeons' concerns regarding failed blocks, complications, and case delays must be addressed [24], and surgeons may rally behind a regional anesthesia program that improves operating room efficiency [25]. When a regional anesthesia program gains surgeon support, the dividends multiply. Since surgeons establish rapport with patients several days or weeks before the surgery, their recommendation in favor of regional anesthesia is likely to lead to higher utilization of these services.

Despite the common belief that surgeons represent the major obstacle to developing a regional anesthesia service, it is often the *anesthesiology practice* itself that requires the most convincing. Since the initial investment in money, training, and personnel is incurred by the practice, there must be tangible benefits from implementing a new service. The ability to recoup this cost is dependent on the model of regional anesthesia practice implemented and the anticipated volume of nerve block procedures. For a busy orthopedic hospital, a new regional anesthesia service may generate enough new revenue to support the salary of one dedicated regional