ANESTHESIA AND
ORTHOPAEDIC
SURGERY
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ANESTHESIA AND ORTHOPAEDIC SURGERY

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This work is dedicated to the loving memory of Anneli, who was taken from us far too soon.
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In recent years, orthopaedic anesthesia has generated growing interest as an anesthesia subspecialty of its own. This development has been driven by multiple factors, including an aging population, improved joint replacement hardware, improved surgical techniques, and a growing expectation that life need not be inevitably limited by joint degeneration. Interest in this specialty is not an entirely new phenomenon. A search for textbooks about orthopaedic anesthesia reveals eight textbooks published between 1980 and the present: one each in 1980, 1992, and 1993, two in 1994, one in 1995, and two in 2005. Each of these texts has addressed some of the unique characteristics of orthopaedic surgical procedures and the resulting anesthetic considerations.

However, little has been written about the way in which a real understanding of the surgical procedure affects anesthetic choice. Furthermore, contemporary anesthetic practice does not end in the recovery room. The formulation of a perioperative anesthetic plan should incorporate the patient’s preexisting medical condition, the planned surgical procedure, postoperative surgical evaluation and monitoring, postoperative analgesia, rehabilitation plan, and reduction of postoperative complications. As an example, in a healthy patient scheduled for bilateral acetabular osteotomies, the use of combined epidural/general anesthesia with pharmacologic manipulation of the physiologic response to surgery produces both decreased blood loss and improved surgical conditions. Maintenance of the epidural provides excellent postoperative analgesia while minimizing the need for additional opioid analgesics. However, the epidural may be used for only a short period of time because postoperative anticoagulation is recommended to minimize the risk of thromboembolic complications. In other postoperative settings, the use of early and aggressive rehabilitation has been associated with shortened times to recovery and restoration of range of motion. Judicious use of regional analgesia has been demonstrated to facilitate this process.

In this text, the editor has assembled an extremely talented and knowledgeable group of chapter authors from a variety of specialties and seeks to address four specific areas of orthopaedic anesthesia. The first part of the book discusses basic principles. The second part addresses orthopaedic surgical procedures by region or joint and provides insight into the surgical technique, the type of anesthetic required, postoperative evaluation, rehabilitation, and complications associated with a given surgical procedure. The third part covers regional anesthesia, continuous nerve and neuraxial blocks, and ambulatory treatment of postoperative pain. The fourth part deals with a range of orthopaedic anesthesia topics: nerve injury, bone cement, and battlefield injuries.

Textbooks are written for a variety of purposes: to fill educational gaps, to record the learning of a lifetime, to promote one’s academic institution or oneself, or in some cases to express passion for a topic or practice that other outlets are insufficient to express. This textbook has been written for the last-named purpose. The editor of this text is innovative, thoughtful, progressive, and passionate about the application of sound anesthetic practices to this unique subset of patients and surgical procedures. In addition, he is passionate about the education of orthopaedic anesthesia providers and he understands that success in this area will produce a wide-ranging impact on patient care in the United States and abroad. In his pursuit of excellence in education, he has developed a variety of new teaching tools, regional anesthetic approaches, and educational courses and is widely recognized—locally, nationally, and internationally—as an expert in regional and orthopaedic anesthesia.

On a personal note, it has been a unique pleasure to watch the editor assemble this text. He has invested countless hours in this project but has done so without complaint and frequently with unbridled excitement about the latest contribution of a chapter author. I have no doubt that this text will become a foundation for continuing orthopaedic anesthesia education and practice. I expect that this text will find its way onto the bookshelf of every serious regional and orthopaedic anesthesiologist. I know that it will grace my own shelf and will have well-worn corners from frequent use.

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Orthopaedic anesthesia as a fully fledged subspecialty of anesthesiology has acquired an extensive literature of its own. This book is an attempt to bring under one cover a survey of the most important topics that directly or indirectly affect the practice of this subspecialty. Although the subject matter covers a wide range, we do not claim exhaustiveness or final authority. Nevertheless, the editor and the contributing authors hope that readers will find this book useful as a guide to, and reminder of, the many problems that confront the orthopaedic anesthesiologist.

The importance of orthopaedic anesthesiology cannot be overstated. With the massive increase in the number of procedures for joint replacements, spinal surgery, and trauma, orthopaedic surgery now constitutes approximately 30 percent of all major surgical procedures performed in the United States.

Although this book is aimed mainly at anesthesiologists-in-training and practicing anesthesiologists, an attempt has also been made to highlight orthopaedic surgical problems. The aim has been to promote an increased mutual understanding between anesthesiologists and surgeons. It has been said that anesthesia without surgeons would be a pleasure. Surgeons, no doubt, have voiced similar feelings. Of course, the fact is that neither can function without the other. The welfare of our patients depends to a large extent on teamwork. If this book helps to promote better mutual understanding and more efficient teamwork between anesthesiologists and surgeons, the editor and the authors will have been well rewarded.

The editor was privileged to obtain contributions by experienced authors as well as by several first-time authors. In all cases, the choice of contributors was based on their acknowledged expertise and international recognition. Younger authors were usually paired with more established writers as the second author. This collaboration resulted in a blend of fresh (even exuberant) youthful approaches with the wisdom of more experienced practitioners. Although this was not a time-proven recipe, I believe that it has been successful for this book. I tried my best to avoid unnecessary repetition of work from other texts. To my knowledge, this is the first comprehensive textbook on orthopaedic anesthesia as a subspecialty.

All of the drawings of anatomy and surgical procedures were done from specially prepared cadaver dissections, photographs, or other primary illustrative material.

The book is divided into four parts. The first part deals with basic principles. Although they are applicable to anesthesia in general, these principles must be thoroughly understood by practitioners who provide anesthesia for orthopaedic surgery. The topics included here involve antimicrobial and thromboprophylaxis, homeostasis in trauma, fat embolism, and a special chapter on dysmorphic children. A selection of Adrian Bösenberg’s unique collection of photographs, taken during his humanitarian work all over the world, is published here for the first time.

The second part has been written by orthopaedic surgeons paired with anesthesiologists and deals with orthopaedic surgical procedures organized by region or joint. Authors were asked to address basic anatomical and surgical aspects and to emphasize comorbidities, anesthetic management, intra- and postoperative pain management, and rehabilitation. These chapters also explain how surgeons, anesthesiologists, physical therapists, and nurses can work as a team to provide the best care for patients by understanding issues from the perspective of the different specialties. Todd McKinley wrote a unique chapter on fractures and crush injuries, which, among other things, makes the poorly understood compartment syndrome clearer. In addition to the major joints, there are chapters on hand and foot surgery and on spinal surgery in adults and children. Ned Amendola, Brian Wolf, and their team cover sports injuries in detail. In this second part, the authors’ experience and a list of suggested readings are used instead of formal lists of references to primary literature.

The third part covers regional anesthesia, more specifically continuous nerve and neuraxial blocks and ambulatory treatment of postoperative pain. All of the nerve blocks required for routine orthopaedic anesthesia are discussed in detail. Basic principles on topics such as the physics of electrical nerve stimulation and the use of ultrasound are also discussed in detail. Also included are chapters on local anesthetic infusion strategies, home care of patients with continuous nerve blocks, and nerve
blocks in children. This part of the book should provide the basic information that practitioners will need for regional anesthesia in orthopaedic surgery.

The final part deals with miscellaneous special topics of which the orthopaedic anesthesiologist should have a thorough knowledge. These topics include nerve injuries, their prevention and management, and problems associated with the use of bone cement. The final chapter covers battlefield orthopaedic anesthesia by Trip Buckenmaier, who recently served in the Iraq war theater.
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The idea for this book arose from a suggestion by my good friend and colleague Dr. Admir Hadzic, while we were teaching regional anesthesia (and fly-fishing) in Chile. I acknowledge with thanks all his behind-the-scenes help and sincerely thank him for always being there when I needed sound advice.

I acknowledge with gratitude the enormous contribution of Dr. Chris Theron (Oranjezicht, Cape Town, South Africa) in editing the text. I am also deeply indebted to Dr. Michael Todd and my other colleagues and partners in the Department of Anesthesia of the University of Iowa for their continuous encouragement, support, and advice. I am especially indebted to them for allowing me time away from the operating room to complete this work. A special word of thanks goes to Dr. Richard Rosenquist, a special friend, partner, and colleague, for his advice and continued encouragement and support. Of course, I am deeply indebted to the contributing authors of this book for their unstinting cooperation.

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