

© Churchill Livingstone Inc. 1981

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without prior permission of the publishers (Churchill Livingstone Inc., 19 West 44th Street, New York, N.Y. 10036).

Distributed in the United Kingdom by Churchill Livingstone, Robert Stevenson House, 1-3 Baxter's Place, Leith Walk, Edinburgh EH1 3AF and by associated companies, branches and representatives throughout the world.

First published 1981
Printed in U.S.A.

ISBN 0-443-08082-8

7 6 5 4 3 2 1

Library of Congress Cataloging in Publication Data

Main entry under title:

Anesthesia.

Bibliography: p.
Includes index.

1. Anesthesia. I. Miller, Ronald D.,
1939- [DNLM: 1. Anesthesia. WO 200
A573]
RD81.A54 617'.96 81-6149
ISBN 0-443-08082-8 AACR2

Contributors

David D. Alfery, M.D.

Staff Anesthesiologist, St. Thomas Hospital, Nashville, Tennessee

Jeffrey M. Baden, M.B., B.S., F.F.A.R.C.S.

Assistant Professor of Anesthesia, Department of Anesthesia, Stanford University School of Medicine, Stanford, California; Staff Anesthesiologist, Anesthesiology Service, Veterans Administration Medical Center, Palo Alto, California

R. Dennis Bastron, M.D.

Associate Professor, Department of Anesthesiology, University of Arizona; Chief, Anesthesiology Service, Veterans Administration Medical Center, Tucson, Arizona

Jonathan L. Benumof, M.D.

Associate Professor of Anesthesia, University of California, San Diego, School of Medicine, San Diego, California

Stephen M. Brzica, M.D.

Staff Anesthesiologist, St. Paul Surgical Center, St. Paul, Minnesota

Benjamin G. Covino, Ph.D., M.D.

Professor of Anaesthesia, Harvard Medical School; Chairman, Department of Anesthesia, Brigham and Women's Hospital, Boston, Massachusetts.

Judith H. Donegan, M.D.

Associate Professor, Department of Anesthesiology, The Medical College of Wisconsin, Milwaukee, Wisconsin

John V. Donlon, Jr., M.D.

Assistant Clinical Professor, Anaesthesia, Harvard Medical School; Assistant Clinical Director, Anesthesia, Massachusetts Eye and Ear Infirmary, Boston Massachusetts

Edmond I. Eger II, M.D.

Professor and Vice Chairman for Research, Department of Anesthesia, University of California, San Francisco, School of Medicine, San Francisco, California

Thomas W. Feeley, M.D.

Assistant Professor of Anesthesia, Associate Medical Director, Intensive Care Units, Stanford University School of Medicine, Stanford, California

Adolph H. Giesecke, Jr., M.D.

Jenkins Professor and Chairman, Department of Anesthesiology, University of Texas Southwestern Medical School, Dallas, Texas

George A. Gregory, M.D.

Professor, Departments of Anesthesia and Pediatrics; Director, Pediatric Intensive Care Unit, University of California, San Francisco, School of Medicine, San Francisco, California

Robert F. Hickey, M.D.

Associate Professor, Department of Anesthesia, University of California, San Francisco, School of Medicine; Chief, Anesthesia Services, Veterans Administration Medical Center, San Francisco, California

Carl C. Hug, Jr., M.D., Ph.D.

Professor of Anesthesiology and Pharmacology; Associate Director, Division of Cardiothoracic Anesthesia, Department of Anesthesiology, Emory University School of Medicine, Atlanta, Georgia

Joel A. Kaplan, M.D.

Professor of Anesthesiology; Director, Division of Cardiothoracic Anesthesia, Department of Anesthesiology, Emory University School of Medicine, Atlanta, Georgia

Robert R. Kirby, M.D.

Professor and Chairman, Department of Anesthesiology, Tulane University, School of Medicine, New Orleans, Louisiana

Donald D. Koblin, Ph.D.

Assistant Research Chemist, Department of Anesthesia, University of California, San Francisco, School of Medicine, San Francisco, California

Gershon Levinson, M.D.

Associate Professor of Anesthesia and Obstetrics, Gynecology, and Reproductive Sciences, Department of Anesthesia, University of California, San Francisco, School of Medicine, San Francisco, California

Ronald D. Miller, M.D.

Professor of Anesthesia and Pharmacology, Department of Anesthesia, University of California, San Francisco, School of Medicine, San Francisco, California

Terence M. Murphy, M.B., Ch.B., F.F.A.R.C.S.

Professor of Anesthesia, Director of Clinical Pain Service, University of Washington, School of Medicine, Seattle, Washington

Fredrick K. Orkin, M.D.

Associate Professor of Anesthesiology, Hahnemann Medical College and Hospital; formerly, Assistant Professor of Anesthesia and Research Medicine (Epidemiology), University of Pennsylvania, Philadelphia, Pennsylvania

Edward G. Pavlin, M.D.

Associate Professor of Anesthesiology, University of Washington School of Medicine, Seattle, Washington

Arthur L. Quasha, M.D.

Assistant Clinical Professor, Department of Anesthesia, University of California, San Francisco, School of Medicine, San Francisco, California

Susan A. Rice, Ph.D.

Assistant Professor of Pharmacology and Toxicology in Anesthesia, Department of Anesthesia, Stanford University School of Medicine, Stanford, California; Research Pharmacologist, Anesthesiology Service, Veterans Administration Medical Center, Palo Alto, California

Michael F. Roizen, M.D.

Associate Professor of Anesthesia, Medicine, and Pharmacology, Department of Anesthesia, University of California, San Francisco, School of Medicine, San Francisco, California

Myer H. Rosenthal, M.D.

Associate Professor of Anesthesia, Medicine, and Surgery; Medical Director, Intensive Care Units and Intermediate Intensive Care Unit, Stanford University Medical Center, Stanford, California

John J. Savarese, M.D.

Associate Professor of Anaesthesia, Harvard Medical School; Associate Anesthetist, Massachusetts General Hospital, Boston, Massachusetts

Harvey M. Shapiro, M.D.

Professor of Anesthesiology and Neurosurgery, Department of Neuroanesthesia Research, University of California at San Diego, School of Medicine; Staff Physician, Anesthesia Service, Veteran's Administration Hospital, San Diego, California

Sol M. Shnider, M.D.

Professor and Vice Chairman; Professor of Obstetrics, Gynecology, and Reproductive Sciences; Department of Anesthesia, University of California, San Francisco, School of Medicine, San Francisco, California

Robert A. Smith, B.A., R.R.T.

Clinical Instructor, Department of Anesthesiology, Tulane University School of Medicine, New Orleans, Louisiana; Clinical Specialist, Department of Critical Care Medicine, Memorial Hospital of Jacksonville, Jacksonville, Florida

Theodore H. Stanley, M.D.

Professor of Anesthesiology, Research Professor of Surgery, Department of Anesthesiology, University of Utah, College of Medicine, Salt Lake City, Utah

Robert K. Stoelting, M.D.

Professor and Chairman, Department of Anesthesia, Indiana University School of Medicine, Indianapolis, Indiana

Preface

In recent years an ever-increasing number of monographs on specific aspects of anesthesia have appeared. However, there is still no comprehensive, up-to-date American reference work that covers the entire field of anesthesia. I felt that anesthesiologists would welcome a ready reference to which they could turn for a survey of the current state of the art. And so, when the publisher extended an invitation to organize and edit just such a book, the decision was made—after consultation with friends and colleagues—to accept this major challenge.

The reader will notice that this text, while comprehensive, is not encyclopedic. I assumed that the reader would be familiar with those aspects of elementary anesthesia practice not included in this book. The focus, therefore, is on major areas of new development in anesthesia that have occurred in the last 20 years. While the emphasis of the book is clinical, the physiological and pharmacologic principles on which a sound anesthesia practice can be based are also presented.

The contributors were requested to provide a scholarly analysis of the topic on which they were writing. In some cases, this analysis included challenging the efficacy of rarely challenged dictates in the practice of anesthesia, such as Dr. Roizen's analysis of the traditional preoperative evaluation (Ch. 1) and Dr. Kirby and Mr. Smith's analysis of intensive care units (Ch. 44). The contributors were given no restriction on the number of references that could be cited, and so the reader desiring a more detailed account of a particular subject will find a comprehensive list of references to the literature. Last and perhaps most important, I did not attempt to impose a uniform point of view. For example, the preoperative evaluation and treatment of the patient with hypertension is discussed in several chapters. This allows the reader to evaluate most of the points of view with special reference to the type of surgery being proposed (e.g., hypertension and vascular surgery).

The success of any multiauthored book is in large part dependent on the expertise of the contributors and the degree of their commitment. The contributors to this book were invited because they are acknowledged authorities in their fields. This has truly been a collaborative effort, and for that reason the names of the contributors join mine on the front cover. Without their support and participation, this book would not exist. They have my deepest thanks.

I appreciate the help and flexibility provided by the staff of Churchill Livingstone, especially Donna Balopole, during the entire project. And last—but certainly not least—I am especially grateful to my family and colleagues for their patience during the time *Anesthesia* was in preparation. Their encouragement and understanding were a continuing source of strength.

Ronald D. Miller

Contents

VOLUME 1

Section I. Preparation of the Patient/Use of Anesthetic Agents: Preoperative

1. Routine Preoperative Evaluation	3
<i>Michael F. Roizen, M.D.</i>	
Introduction	3
Preoperative Screening for Healthy Individuals for Routine Surgery—What Should be Done?	3
What is an Abnormal Laboratory Text?	4
The Medicolegal Rationale for Laboratory Testing	15
Practical History and Physical Examination	16
Other Screening Laboratory Tests	16
2. Preoperative Evaluation of Patients with Diseases that Require Special Preoperative Evaluation and Intraoperative Management	21
<i>Michael F. Roizen, M.D.</i>	
Introduction	21
Diseases Involving the Endocrine System and Disorders of Nutrition	21
Diseases Involving the Cardiovascular System	35
Disorders of the Respiratory and Immune Systems	44
Diseases of the Central Nervous System, Neuromuscular Diseases, and Psychiatric Disorders	48
Renal Disease, Infectious Diseases, and Disorders of Electrolytes	55
Gastrointestinal and Liver Disease	62
Hematologic Disorders and Oncologic Disease	65
Patients Receiving Drug Therapy for Chronic and Acute Medical Conditions	70
3. Psychological Preparation and Preoperative Medication	95
<i>Robert K. Stoelting, M.D.</i>	
Preoperative Psychological Preparation	95
Preoperative Pharmacologic Preparation	96
Drugs for Preoperative Medication	96
Evaluation of Drugs Used for Preoperative Medication	102
Recommended Approach to Preoperative Medication	102

4. The Immediate Preinduction Period	107
<i>Ronald D. Miller, M.D.</i>	
Introduction	107
Questions the Anesthesiologist Should Ask	108
Summary	113
 Section I. Preparation of the Patient/Use of Anesthetic Agents: Intraoperative	
5. Anesthetic Systems	117
<i>Fredrick K. Orkin, M.D.</i>	
Introduction	117
Physical Principles	118
Breathing Systems	136
Controlling Exposure to Waste Anesthetic Gases	147
6. Monitoring	157
<i>Carl C. Hug, Jr., M.D., Ph.D.</i>	
Introduction	157
The Central Nervous System	161
Ventilation	165
The Cardiovascular System	173
Renal Failure	196
Body Temperature	197
The Anesthesia Laboratory	199
7. The Electrocardiogram and Anesthesia	203
<i>Joel A. Kaplan, M.D.</i>	
Introduction	203
Dysrhythmia Detection	204
Conduction Abnormalities	218
Myocardial Ischemia	221
8. Endotracheal Intubation	233
<i>Robert K. Stoelting, M.D.</i>	
Introduction	233
Preoperative Evaluation of the Patient	233
Indications for Orotracheal Intubation	235
Technique for Orotracheal Intubation	236
Awake Endotracheal Intubation	242
Nasotracheal Intubation	242
Technique for Fiberoptic Laryngoscopy	244
Retrograde Intubation	245
Endotracheal Intubation in Children	245
Extubation	247
Complications of Endotracheal Intubation	247
Deliberate Endobronchial Intubation	251
9. MAC	257
<i>Arthur L. Quasha, M.D. and Edmond I. Eger II, M.D.</i>	
Introduction	257
Definition	257
Technical Aspects of Obtaining MAC in Animals and Humans	258
What Affects MAC	260

MAC and Pharmacologic Principles	275
Summary	275
10. How Do Inhaled Anesthetics Work?	283
<i>Donald D. Koblin, Ph.D. and Edmond I. Eger II, M.D.</i>	
Introduction	283
Measurement of Anesthetic Potencies	283
Alterations in Anesthetic Requirement Pertinent to Theories of Narcosis	284
Where do Inhaled Anesthetics Act in the Central Nervous System?	285
Anesthetic Blockade of Synaptic and Axonal Transmission	286
Physicochemical Nature of the Site of Anesthetic Action	290
Future Studies	299
Conclusions	300
11. Uptake and Distribution of Inhaled Anesthetics	309
<i>Edmond I. Eger II, M.D.</i>	
Introduction	309
The Inspired to Alveolar Anesthetic Relationship	309
Factors Modifying the Rate of Rise of F_A/F_I	315
The Effect of Nitrous Oxide on Closed Gas Spaces	322
Anesthetic Circuitry	324
Recovery From Anesthesia	326
12. Circulatory Pharmacology of Inhaled Anesthetics	331
<i>Robert F. Hickey, M.D. and Edmond I. Eger II, M.D.</i>	
Introduction	331
Human Volunteer Studies	331
The Effect of Disease	341
The Effect of Surgery	344
Summary	345
13. Respiratory Pharmacology of Inhaled Anesthetic Agents	349
<i>Edward G. Pavlin, M.D.</i>	
Introduction	349
Effects on Bronchomotor Tone	349
Effects on Pulmonary Vascular Resistance	356
Effects on Mucociliary Function	363
Effects on the Control of Ventilation	368
14. Metabolism and Toxicity of Inhaled Anesthetics	383
<i>Jeffrey M. Baden, M.B., B.S. and Susan A. Rice, Ph.D.</i>	
Introduction	383
Metabolism	383
Physicochemical Considerations	383
Drug Metabolism	386
Metabolism of Specific Anesthetic Agents	392
Toxicity	396
Mechanisms of Toxicity	396
Acute Toxicity	398
Chronic Toxicity	406
15. Pharmacology of Intravenous Narcotic Anesthetics	425
<i>Theodore H. Stanley, M.D.</i>	
Introduction	425
History	425

Classification	427
Mode of Action	427
Analgesia-Amnesia-Anesthesia	430
Cardiovascular Actions	430
The Use of Supplements	433
Effects on Respiration	435
Effects on the Kidney	437
Effects on the Gastrointestinal Tract	437
Metabolism and Stress-Free Anesthesia	437
Effects on Neuromuscular Transmission	438
Pharmacokinetics	438
16. Pharmacology of Intravenous Non-Narcotic Anesthetics	451
<i>Theodore H. Stanley, M.D.</i>	
Introduction	451
The Barbiturates	451
The Benzodiazepines	458
The Butyrophenones and Neuroleptanalgesia	462
The Eugenols	463
The Steroid Anesthetics	466
Other Anesthetics	469
17. Pharmacology of Muscle Relaxants, Their Antagonists, and Monitoring of Neuromuscular Function	487
<i>Ronald D. Miller, M.D. and John J. Savarese, M.D.</i>	
Introduction	487
Normal Neuromuscular Function	488
Types of Neuromuscular Blockade	490
Monitoring of Neuromuscular Function	491
Pharmacology of Nondepolarizing Muscle Relaxants	496
Pharmacology of Depolarizing Muscle Relaxants	509
Antagonism of a Nondepolarizing Neuromuscular Blockade	518
Drug Interactions	523
Diseases That May Alter Muscle Relaxant Action	526
New Drugs	529
18. Pharmacology of the Autonomic Nervous System	539
<i>Ronald D. Miller, M.D. and Robert K. Stoelting, M.D.</i>	
Anatomy	539
Transmission	539
Receptors	539
Catecholamines	542
Pharmacology of Antihypertensive Drugs	550
Pharmacology of Cholinergic and Anticholinergic Drugs	556

Section I. Preparation of the Patient/Use of Anesthetic Agents:

Regional Anesthesia

19. Pharmacology of Local Anesthetic Drugs	563
<i>John J. Savarese, M.D. and Benjamin G. Corino, Ph.D., M.D.</i>	
Introduction	563

Basic Pharmacology	563
Chemistry	563
Nerve Structure and Function	567
Mechanism of Action of Local Anesthetic Drugs (Pharmacodynamics)	571
Clinical Pharmacology	576
Choice of Local Anesthetic	576
Development of Tachyphylaxis	578
Topical Anesthesia	579
Kinetics of Nerve Block	579
Hypersensitivity	581
Systemic Effects of Local Anesthetics (Local Anesthetic Toxicity)	581
Pharmacokinetics	585
20. Nerve Blocks	593
<i>Terence M. Murphy, M.B., Ch.B.</i>	
Introduction	593
Clinical Management	594
Premedication	597
Equipment	597
General Technique	601
Nerve Blocks of the Upper Extremity	602
Nerve Blocks of the Lower Extremity	611
Nerve Blocks at the Ankle	618
Nerve Blocks in the Head and Neck	620
Intercostal Nerve Blocks	625
Paravertebral Nerve Blocks	627
Sacral Nerve Block	628
Intravenous Regional Anesthesia	629
Complications of Regional Nerve Blocks	630
21. Spinal, Epidural, and Caudal Anesthesia	635
<i>Terence M. Murphy, M.B., Ch.B.</i>	
Spinal and Epidural Anesthesia	635
History	635
Fundamental Considerations	635
Applied Anatomy	636
Clinical Aspects	643
Spinal Anesthesia (Subarachnoid Block)	647
Epidural Anesthesia	660
Caudal Anesthesia	672
Anatomy of the Caudal Canal	673
Technique of Caudal Anesthesia	674
Use of Caudal Anesthesia in Pediatric Surgery	675
Subarachnoid and Epidural Injection of Narcotics	675

Section II. Physiological Functions During Anesthesia

22. Respiratory Physiology and Respiratory Function During Anesthesia	681
<i>Jonathan L. Benumof, M.D.</i>	
Respiratory Physiology	681

Introduction	681
Distribution of Pulmonary Perfusion, Ventilation, and the Ventilation/ Perfusion Ratio	681
Clinically Important Determinants of Pulmonary Vascular Resistance and Blood Flow Distribution	686
Clinically Important Determinants of Compliance, Resistance, and Lung Volumes	688
Oxygen and Carbon Dioxide Transport	697
Pulmonary Structure and Function	703
Respiratory Function During Anesthesia	707
Introduction	707
Effect of Anesthetic Depth on Respiratory Pattern and Function	707
Preexisting Respiratory Dysfunction	708
Special Intraoperative Conditions	709
Mechanisms of Hypoxemia During Anesthesia	709
Mechanisms of Hypercapnia and Hypocapnia During Anesthesia	720
Physiological Effects of Abnormalities in the Respiratory Gases	721
23. Cardiovascular Physiology	731
<i>Joel A. Kaplan, M.D.</i>	
Cardiac Output	732
Ventricular Function	740
Physiology of the Coronary Circulation	751

Index

VOI UME 2

24. Hepatic and Renal Physiology	763
<i>R. Dennis Bastron, M.D.</i>	
Hepatic Physiology	763
Liver Function Tests	765
Effects of Anesthesia on Hepatic Function	766
Anesthetic Considerations for Patients with Liver Dysfunction	769
Differential Diagnosis of Postoperative Hepatic Dysfunction	770
Halothane Hepatitis—Fact or Fiction?	770
Renal Physiology	771
Renal Circulation	772
Control of the Renal Circulation	773
Tubular Function	774
Clinical Evaluation of Renal Function	776
Pharmacology of Diuretics	778
Effects of Anesthesia on Renal Function	784
25. Anesthesia Effects upon Cerebral Blood Flow, Cerebral Metabolism, and the Electroencephalogram	795
<i>Harvey M. Shapiro, M.D.</i>	
Introduction	795
Measurement of Cerebral Blood Flow, Cerebral Metabolic Rate, and the Electroencephalogram	795

Regulation of Cerebral Blood Flow	800
Overall Cerebral Blood Flow Responses	802
Effects of Anesthetic Agents on Cerebral Blood Flow, Cerebral Metabolic Rate, and the Electroencephalogram	804
Cerebral Blood Flow and Cerebral Metabolic Rate in Pathologic States	815
26. Acid-Base Equilibrium and Blood-Gas Measurement	825
<i>Myer H. Rosenthal, M.D.</i>	
Introduction	825
Oxygen	825
Carbon Dioxide	829
Acid-Base Physiology	831
Blood-Gas Measurement	857
27. Perioperative Fluid Therapy—Crystalloids	865
<i>A. H. Giesecke, Jr., M.D.</i>	
Introduction	865
Types of Intravenous Fluids	865
Routine Intraoperative Fluids	866
Evaluation of Fluid Status	868
Pathophysiology of Volume Deficiency	876
28. Blood, Blood Component, Colloid, and Autotransfusion Therapy	885
<i>Ronald D. Miller, M.D. and Stephen M. Brzica, M.D.</i>	
Blood Therapy	885
Compatibility Testing	885
Common Transfusion Practices	887
Storage of Blood	890
Complications	893
Blood Component Therapy	910
Packed Erythrocytes	911
Platelet Concentrates	913
Fresh Frozen Plasma	914
Cryoprecipitate	914
Prothrombin Complex	915
Single Donor Plasma	915
Albumin and Plasma Protein Preparations	915
Granulocyte Concentrate	916
Artificial Colloid Solution Therapy	916
Autotransfusion Therapy	917
Preoperative Removal and Storage	917
Immediate Preoperative Phlebotomy and Hemodilution	917
Intraoperative Blood Salvage and Retransfusion	918

Section III. The Systems and Specific Areas

29. Anesthesia for Thoracic Surgery	925
<i>David D. Alfery, M.D. and Jonathan L. Benumof, M.D.</i>	
Introduction	925
Management of Patients for Thoracic Surgery	926
The Preoperative Period	926

The Intraoperative Period	930
The Postoperative Period	951
Anesthesia for Specific Procedures	958
Mediastinoscopy	958
Massive Pulmonary Hemorrhage	960
Giant Bullous Emphysema and Air Cysts	961
Bronchopleural Fistula	963
Unilateral Bronchopulmonary Lavage	964
Tracheal Resection	965
30. Anesthesia for Cardiac Surgery	981
<i>Carl C. Hug, Jr., M.D., Ph.D.</i>	
Introduction	981
The Patient	982
The Surgery	986
The Anesthetic Plan	1004
Postoperative Considerations	1024
31. Anesthesia for Vascular Surgery	1027
<i>Theodore H. Stanley, M.D.</i>	
Introduction	1027
Preoperative Care and Evaluation	1027
Monitoring	1041
General Anesthesia	1047
Regional Anesthesia for Aortic Operations	1050
Anesthesia for Carotid Artery Operations	1050
Fluid Management During Operation	1051
Recovery and the Postoperative Period	1052
32. Anesthesia for Genitourinary Surgery	1061
<i>R. Dennis Bastron, M.D.</i>	
Acute Renal Failure	1061
Chronic Renal Failure	1064
Special Considerations	1071
33. Neurosurgical Anesthesia and Intracranial Hypertension	1079
<i>Harvey M. Shapiro, M.D.</i>	
Introduction	1079
Intracranial Hypertension	1079
Intracranial Pressure Dynamics	1079
Signs and Symptoms	1084
Management	1084
General Methods to Reduce Elevated ICP	1089
Neurosurgical Anesthesia	1091
Monitoring	1091
Clinical Practice	1101
Common Intracranial Neurosurgical Problems	1108
Special Problems in Neurosurgical Anesthesia	1118
34. Obstetric Anesthesia	1133
<i>Sol M. Shnider, M.D. and Gershon Levinson, M.D.</i>	
Introduction	1133
Physiological Changes in the Mother During Pregnancy	1133

Pain Pathways	1141
Placental Transfer of Anesthetics	1141
Anesthesia for Vaginal Delivery	1143
Anesthesia for Cesarean Section	1157
Emergency Cesarean Section	1160
Anesthesia for Complicated Obstetrics	1160
Anesthesia for Operations During Pregnancy	1166
Conclusions	1167
35. Resuscitation of the Newborn	1175
<i>George A. Gregory, M.D.</i>	
Introduction	1175
Perinatal Cardiorespiratory Physiology	1175
Asphyxia	1177
Assessment of the Fetus at Birth	1178
Resuscitation Equipment	1179
Procedure	1181
Pulmonary Resuscitation	1184
Vascular Resuscitation	1187
Correction of Acidosis	1188
Expansion of Intravascular Volume	1190
Cardiac Massage	1193
Resuscitation Drugs	1194
When to Discontinue Therapy	1194
36. Pediatric Anesthesia	1197
<i>George A. Gregory, M.D.</i>	
Introduction	1197
Differences Between Adults and Children	1197
Malignant Hyperthermia	1208
Conduct of Anesthesia	1212
Induction of Anesthesia	1215
Maintenance of Anesthesia	1216
Monitoring During Anesthesia	1217
Blood Loss and Fluid Replacement	1220
Conduction Anesthesia	1222
Summary and Case Reports	1223
37. Anesthesia for the Elderly	1231
<i>Ronald D. Miller, M.D.</i>	
Introduction	1231
Physiology	1231
Pharmacology	1235
Anesthetic Management	1238
Summary	1245
38. Anesthesia for Trauma Surgery	1247
<i>A. H. Giesecke, Jr., M.D.</i>	
Introduction	1247
Preanesthetic Evaluation	1247
Premedication	1248
Airway Problems	1249

Fiberoptic Endotracheal Intubation	1252
Full Stomach	1252
Multiple Injuries	1254
Intoxication	1255
Shock	1256
Monitoring	1259
Injuries that Require Special Anesthetic Management	1260
Recovery Room Care	1262
39. Anesthesia for Eye, Ear, Nose, and Throat Surgery	1265
<i>John V. Donlon, Jr., M.D.</i>	
Anesthesia for Ophthalmic Surgery	1265
Mortality	1266
Choice of Anesthetic	1266
Intraocular Pressure	1267
Oculocardiac Reflex	1272
Systemic Effects of Ophthalmic Drugs	1273
General Anesthesia	1275
Local Anesthesia	1280
Anesthesia for Specific Ophthalmic Conditions	1283
Anesthesia for Electoretinogram Studies	1285
Anesthesia for Intraocular Procedures	1285
Postoperative Care	1286
Anesthesia for Ear, Nose, and Throat (ENT) Surgery	1286
Functional Laryngeal Anatomy	1287
Ear Surgery	1290
Nasal and Sinus Surgery	1292
Endoscopy Techniques	1294
Major Head and Neck Cancer Surgery	1300
Tonsillectomy	1302
Tracheostomy	1304
Anesthetic Management of Patients with a T Tube	1306
Oral Surgery	1307
Facial Trauma	1308
Laryngeal and Tracheal Trauma	1308
Tracheal Stenosis	1309
Compromised Airway Management	1310
Summary	1315
40. Out-Patient Anesthesia	1323
<i>George A. Gregory, M.D.</i>	
Introduction	1323
Benefits	1323
Facilities	1324
Criteria for Out-Patient Anesthesia and Surgery	1324
Preoperative Considerations	1325
Anesthesia	1327
Monitoring	1330
Recovery from Surgery and Anesthesia	1331
Complications	1331
Summary	1332

41. The Recovery Room	1335
<i>Thomas W. Feeley, M.D.</i>	
Introduction	1335
Design and Staffing	1336
Routine Recovery	1337
Respiratory Complications	1339
Circulatory Complications	1347
Agitation and Pain	1352
Renal Complications	1354
Bleeding Complications	1356
Complications of Specific Types of Surgery	1356

Section IV. Consultant Anesthesia Practice

42. Pulmonary Function Testing	1363
<i>Jonathan L. Benumof, M.D. and David D. Alfery, M.D.</i>	
Introduction	1363
The "Silent Zone" of the Lung	1363
Events During a Forced Expiration	1364
The Pulmonary Function Tests	1364
Perspectives in Pulmonary Function Testing	1375
Recommended Procedures for Evaluation of Pulmonary Function (With Special Reference to Pneumonectomy)	1376
43. Respiratory Care	1379
<i>Robert A. Smith, B.A., R.R.T.</i>	
Introduction	1379
Oxygen Therapy	1379
Humidification and Aerosol Therapy	1381
Bronchial Hygiene	1388
Postoperative Respiratory Therapy	1394
Mechanical Ventilation	1396
Potential Complications Associated with Respiratory Care	1420
44. The Anesthesiologist and Intensive Care	1435
<i>Robert R. Kirby, M.D. and Robert A. Smith, B.A., R.R.T.</i>	
Introduction	1435
Historical Development of Intensive Care	1436
The Role of the Anesthesiologist in Critical Care	1437
Ethical and Legal Considerations	1438
Cost Effectiveness	1442
Monitoring	1444
Respiratory Care	1446
Resuscitation—Fluid and Electrolyte Therapy	1450
Resuscitation—Humoral, Blood Component, and Pharmacologic Therapy ...	1453
Unresolved Problems	1455
Summary and Conclusions	1455
45. Treatment of Chronic Pain	1459
<i>Terence M. Murphy, M.B., Ch.B.</i>	