Contents

SECTION I: Fundamental Concepts

1. Applied Anatomy, Physiology and Physics 3

- Respiratory Physiology *3*
- Foreign Body Aspiration *5*
- Regulation of Respiration *6*
- Muscles of Respiration *6*
- Airway Resistance *6*
- Ventilation/Perfusion (V/Q) *6*
- Dead Space *7*
- Oxygen and Carbon Dioxide in Blood *7*
- Abnormalities of Chest Movements *8*
- Hypoxic Pulmonary Vasoconstriction *9*
- Pulmonary Function Tests *9*
- Physics Related to Anesthesia *11*
- Venturi Principle *12*
- Poynting Effect *12*

SECTION II: Equipment in Anesthesia

2. Anesthesia Delivery Systems (Anesthesia Machine and Circuits) 15

- Source of Gases *15*
- Anesthesia Machine *17*
- Breathing Circuits *24*
- Closed, Semiclosed Circuits/Circle System *27*
- Checking of Anesthesia Machine and Circuits *30*
- Safety Features of Anesthesia Delivery Systems *32*

3. Equipment 34

Equipment for Airway Management 34

- Airways *34*
- Facemasks *34*
- Ambu Bag Resuscitator *35*
- Laryngoscopes *35*
- Supraglottic Airway Devices *37*
- Infraglottic Airway Devices *40*
- Nasal Intubation *44*

Other Equipment 46

- Oxygen Delivery Systems in Non-intubated Patient *46*
- Humidification Devices *48*
- Static Current *49*
- Sterilization of Anesthesia Equipment *50*

SECTION III: Quintessential in Anesthesia

4. Preoperative Assessment and Premedication 53

- Preoperative Assessment *53*
- Instructions *54*
- Fasting *56*
- Premedication *56*
- Other instructions *57*

5. Difficult Airway Management 59

- Causes of Difficult Intubation/ Difficult Airway *59*
- Assessment of Difficult Intubation *60*
- Management *61*

6. Monitoring in Anesthesia 64

- Clinical Monitoring *64*

Advance Monitoring (Instrumental Monitoring).....*64*
- Cardiovascular Monitoring *64*
- Respiratory Monitoring *68*
- Temperature Monitoring *73*
- Neuromuscular Monitoring *75*
- Central Nervous System Monitoring *76*
- Mandatory Monitors *78*
- Monitoring Blood Loss *79*
- Fluids *80*
- Crystalloids *80*

7. Fluids and Blood Transfusion.....**80**
- Colloids *81*
- Fluid Management *82*
- Blood Transfusion *84*
- Complications of Blood Transfusion *87*
- Autologous Blood Transfusion *89*

SECTION IV: Introduction to Anesthesia

8. History of Anesthesia.....**93**
- Nitrous Oxide *93*
- Ether *93*
- Chloroform *93*
- Intravenous Anesthetics *93*
- Local Anesthesia *93*
- Muscle Relaxants *94*
- Instruments *94*

SECTION V: General Anesthesia

9. Introduction to General Anesthesia.....**97**
- Components of General Anesthesia *97*
- General Anesthesia Protocol (for a Normal Healthy Patient) *97*
- Stages of Anesthesia *98*

10. Inhalational Agents: General Principles and Individual Agents....**99**
- Classification *99*
- Mechanism of Action of Inhalational Agents *99*
- Potency of Inhalational Agents *100*
- Uptake and Distribution of Inhalational Agents *101*
- Augmented Inflow Effect, Concentration Effect, Second Gas Effect and Diffusion Hypoxia *102*
- Recovery from Inhalational Agents *102*
- Absorption of Inhaled Anesthetic Agent by Anesthetic Circuitry *102*
- Systemic Effects of Inhalational Agents (Including Side Effects and Toxicity) *103*

Individual Inhalational Agents.....*105*
- Gaseous Agents *105*
- Volatile Agents *107*
- Agents no More in Clinical Use *112*

11. Gases Used in Anesthesia.....**115**
- Oxygen *115*
- Oxygen Deficiency (Hypoxia) *116*
- Excessive Oxygen (Oxygen Toxicity) *116*
- Hyperbaric Oxygen *116*
- Nitrous Oxide, Entonox and Xenon *117*
- Nitric Oxide *117*
- Air *118*
- Carbon Dioxide *118*
- Helium/Heliox *118*

12. Intravenous Anesthetics.....**119**
- Classification *119*

Barbiturates.....*119*
- Thiopentone *119*
- Methohexitone *122*

Nonbarbiturates.....*122*
- Propofol *122*
- Etomidate *124*
- Benzodiazepines *124*
- Ketamine *126*
- Opioids *128*
- Alpha 2 Adrenergic Agonists *133*
- Other Intravenous Anesthetics *134*

13. Muscle Relaxants.....**136**
- Physiology of Neuromuscular Junction *136*

- Neuromuscular Monitoring *137*
- Classification of Muscle Relaxants *138*
- Depolarizing Agents *138*
- Nondepolarizing Muscle Relaxants *141*
- Others *144*
- Compounds Under Research *144*
- Reversal of Block *146*
- Signs of Adequate Reversal *147*
- Common Causes of Inadequate Reversal *147*
- Centrally Acting Muscle Relaxants *148*

14. Perioperative Complications of General Anesthesia.....151

Complications.....151
- Mortality *151*

Respiratory Complications.....151
- Hypoxia *151*
- Hypercarbia *155*
- Hypocapnia *155*
- Cough/Hiccups *155*

Cardiovascular Complications 155
- Hypertension *155*
- Cardiac Arrhythmias *155*
- Hypotension *156*
- Myocardial Ischemia *157*
- Cardiac Arrest *157*

Neurological Complications 157
- Convulsions *157*
- Delayed Recovery *157*
- Awareness (Inadequate Amnesia) *157*
- Agitation, Delirium and Emergence Excitement *157*
- Postoperative Cognitive Dysfunction *158*
- Permanent Brain Damage *158*
- Cranial Nerve Palsies *158*
- Extrapyramidal Side Effects *158*
- Peripheral Neuropathies *158*
- Gastrointestinal Complications Postoperative Nausea and Vomiting *158*
- Renal Complications *159*
- Hepatic Complications *159*
- Pain *159*

Thermal Perturbations 159
- Hypothermia and Shivering *159*
- Hyperthermia *159*
- Malignant Hyperthermia *159*
- Anaphylactic/Anaphylactoid Reactions *161*

Complications of Different Positions ..162
- Lithotomy *162*
- Trendelenburg *162*
- Sitting *162*
- Lateral and Prone *162*
- Ocular Complications *162*
- Fires and Electric Hazards in Operation Theater *162*
- Precautions to Prevent Fire and Burns *163*
- Medication Errors *163*
- Occupational Hazards *164*
- Prevention of Complications *164*
- Mandatory Monitoring *164*
- Discharge Criteria from Postanesthesia Care Unit *164*
- Aldrete Recovery Score *164*

SECTION VI: Regional Anesthesia

15. Local Anesthetics 169
- Classification *169*
- Mechanism of Action of Local Anesthetics *170*
- General Considerations in Action of Local Anesthetics *170*
- Systemic Effects and Toxicity *172*
- Commercial Preparations *173*
- Individual Agents *173*
- Methods of Local Anesthesia *176*
- Causes of Failure of Local Anesthesia *177*

16. Peripheral Nerve Blocks.....179
- Technique *179*
- Blocks of Upper Limb *179*
- Blocks of Lower Limb *181*
- Blocks of the Head and Neck, Thoracic and Abdominal Area *181*

- Contraindications for Peripheral Nerve Blocks *182*

17. Central Neuraxial Blocks (Spinal and Epidural Anesthesia) 183
- Applied Anatomy *183*
- Advantages of Central Neuraxial Blocks Over General Anesthesia *185*
- Systemic Effects (Physiological Alterations) of Central Neuraxial Blocks *185*
- Spinal Anesthesia (Subarachnoid Block, Intrathecal Block) *186*
- Spinal Anesthesia in Children *194*
- Saddle Block *194*
- Epidural (Extradural) Anesthesia (Also Called as Peridural Block) *194*
- Combined Spinal Epidural Anesthesia *197*
- Caudal Block (Epidural Sacral Block) *197*
- Level of Block Required for Common Surgeries *199*

SECTION VII: Anesthesia for Coexisting Diseases

18. Anesthesia for Cardiovascular Diseases (For Noncardiac Surgeries).....205
- Ischemic Heart Disease *205*
- Valvular Diseases *207*
- Congenital Heart Diseases *209*
- Heart Failure *210*
- Cardiomyopathies *211*
- Pericardial Diseases (Constrictive Pericarditis/Cardiac Tamponade) *211*
- Considerations in Patients on Cardiac Implanted Electronic Devices (Pacemakers) *211*
- Hypertension *212*
- Hypotension (Anesthesia for Shock Patients) *213*

19. Anesthesia for Respiratory Diseases 215
- General Considerations in Management of Patient with Pulmonary Disease *215*
- Asthma *216*
- Chronic Obstructive Pulmonary Disease (Chronic Bronchitis and Emphysema) *217*
- Restrictive Lung Diseases *217*
- Tuberculosis *218*
- Respiratory Tract Infection *218*
- Operative Criteria for Thoracotomy/ Pneumonectomy *218*

20. Anesthesia for Central Nervous System Diseases 220
- Parkinson's Disease *220*
- Alzheimer's Disease *220*
- Epilepsy *220*
- Stroke *220*
- Headache *221*
- Multiple Sclerosis *221*
- Syringomyelia *221*
- Amyotrophic Lateral Sclerosis *221*
- Guillain-Barré Syndrome *221*
- Autonomic Dysfunction *221*
- Spinal Cord Transection *221*
- Psychiatric Disorders *222*

21. Anesthesia for Hepatic Diseases ...224
- Preoperative Evaluation *224*
- Intraoperative *225*
- Anesthesia for Patients with Biliary Obstruction *226*

22. Anesthesia for Renal Diseases and Electrolyte Imbalances.....227
- Anesthetic Management of Patients with Renal Dysfunction *227*
- Anesthesia for Transurethral Resection of Prostate *228*
- Anesthesia for Patients with Electrolyte Imbalances *229*

23. Anesthesia for Endocrinal Disorders.....231
- Diabetes Mellitus *231*
- Thyroid Dysfunctions *232*
- Hypothyroidism *233*
- Adrenal Dysfunctions *234*
- Pituitary Dysfunction *235*

24. Anesthesia for Neuromuscular Diseases 236
- Myasthenia Gravis *236*
- Myasthenic Syndrome (Eaton-Lambert Syndrome) *237*
- Familial Periodic Paralysis *237*
- Muscular Dystrophies *237*

25. Anesthesia for Immune-mediated and Infectious Diseases 239
- Rheumatoid Arthritis *239*
- Ankylosing Spondylitis *239*
- Systemic Lupus Erythematosus *239*
- Scleroderma *239*
- Human Immunodeficiency Virus and Acquired Immunodeficiency Syndrome *240*

SECTION VIII: Subspecialty Anesthetic Management

26. Anesthesia for Disorders of Blood 243
- Anemia *243*
- Sickle Cell Disease *244*
- Thalassemia *244*
- Polycythemia *244*
- Disorders of Hemostasis *245*
- G6pd Deficiency *245*
- Porphyria *245*

27. Neurosurgical Anesthesia 247
- Cerebral Physiology and Pharmacology *247*
- General Considerations in Neurosurgical Patients *249*
- Anesthesia for Conditions with Raised Intracranial Tension *249*
- Anesthesia for Awake Craniotomies (Stereotactic Surgery) *252*
- Anesthetic Management of Spine Surgeries *253*

28. Anesthesia for Obstetrics 255
- Physiological Changes in Pregnancy *255*
- Effect of Anesthetic Technique/Drugs on Uteroplacental Circulation *256*
- Transfer of Anesthetic Drugs to Fetal Circulation *256*
- Anesthesia for Cesarean Section *257*
- Labor Analgesia (Painless Labor) *258*
- Anesthesia for Manual Removal of Placenta *259*
- Anesthesia for Non-obstetric Surgeries During Pregnancy *259*

29. Pediatric Anesthesia.....261
- Physiological/Anatomical Changes in Pediatric Population *261*
- Anesthetic Management *263*
- Regional Anesthesia in Pediatric Patients *265*
- Management of Neonatal Surgical Emergencies *265*

30. Geriatric Anesthesia 268
- Physiological Changes in Old Age *268*
- Anesthetic Management *268*

31. Anesthesia for Obese Patients (Bariatric Anesthesia) 271
- Preoperative Assessment *271*
- Intraoperative *272*
- Postoperative *272*

32. Anesthesia for Laparoscopy.....274
- Gases for Creating Pneumoperitonium *274*
- Pathophysiological Effects of Laparoscopy *274*
- Complications of Laparoscopy *274*

- Anesthetic Management *276*
- Contraindications for Laparoscopy *276*

33. Anesthesia for Ophthalmic Surgery.....278
- Preoperative Evaluation *278*
- Intraoperative *278*
- Anesthesia *278*
- General Anesthesia *279*

34. Anesthesia for ENT Surgery 281
- Panendoscopy (Previously Called as Microlaryngeal Surgeries) *281*
- Anesthesia for Bronchoscopy *282*
- Anesthesia for Adenotonsillectomy/ Tonsillectomy *282*
- Anesthesia for Peritonsillar Abscess and Ludwig Angina *282*
- Anesthesia for Ear Surgery *283*
- Anesthesia for Nasal Surgery *283*
- Anesthesia for Parotid Surgery *283*
- Anesthesia for Obstructive Sleep Apnea Surgery *283*
- Anesthesia for Temporomandibular Joint Surgeries *283*

35. Anesthesia for Trauma and Burns.....284
- Anesthesia for Trauma *284*
- Anesthesia for Burns *286*

36. Anesthesia for Orthopedics 288
- Complications of Orthopedic Surgery *288*
- Choice of Anesthesia *290*
- Anesthesia for Spine Surgery *290*

37. Anesthesia at Remote Locations 291
- Anesthesia at Low Barometric Pressure (High Altitude) *291*
- Anesthesia at High Pressure (in Hyperbaric Chamber) *291*
- Anesthesia Outside Operating Theater *291*

38. Anesthesia for Daycare Surgery (Outpatient/Ambulatory Surgery) 293
- Selection of Surgery/Procedures and Patients *293*
- Preoperative Assessment and Premedication *293*
- Anesthesia for Daycare Patients *294*
- General Anesthesia *294*
- Total Intravenous Anesthesia *294*
- Regional Anesthesia *294*
- Monitored Anesthesia Care *294*
- Discharge *294*
- Postoperative Period *295*

SECTION IX: Cardiorespiratory Care

39. Pain Management.....299

Assessment of Pain 299

Acute Pain Management.....300
- Method of Relief *300*

Chronic Pain Management 301
- Low Backache *301*
- Neuropathic Pain *301*
- Cancer Pain *302*
- Myofascial Pain Syndrome *302*
- Fibromyalgia *303*

Commonly Used Pain Blocks 303
- Stellate Ganglion Block *303*
- Trigeminal Nerve Block *303*
- Intercostal Nerve Block *304*
- Celiac Plexus Block *304*
- Lumbar Sympathetic Chain Block *304*
- Superior Hypogastric Block *304*
- Ganglion Impar Block *304*

40. Intensive Care Management.....305

Intensive Care Unit.....305

Acute Respiratory Failure 305
- Definition *305*
- Classification *305*

Management of Respiratory Failure...306
- Supplemental Oxygen *306*

- Mechanical Ventilation of Lungs *306*
- Add on Modes/Positive Pressure Airway Therapy *310*
- Noninvasive Positive Pressure Ventilation: Ventilation without Intubation or Tracheostomy *311*
- Weaning from Ventilator *312*
- Complications of Mechanical Ventilation (and Associated Problems) *313*
- Monitoring *314*
- Inotropic Support to Heart *314*
- Shock *314*
- Management of Shock *316*
- Nutritional Support *317*
- Pulmonary Care *320*
- General Nursing Care *320*

***Specific Conditions* 320**
- Sepsis *320*
- Pulmonary Edema *320*
- Hemodynamic Type *320*
- Increased Permeability Type (Noncardiogenic)—Adult Respiratory Distress Syndrome *321*

***Chronic Obstructive Pulmonary Disease* 322**
- Carbon Monoxide Poisoning *322*
- Acid-Base Management *323*
- Respiratory Acidosis *323*
- Respiratory Alkalosis *324*
- Metabolic Acidosis *325*
- Metabolic Alkalosis *326*

41. Cardiopulmonary and Cerebral Resuscitation.....328
- Management of CPCR *328*
- Basic Life Support *329*
- Advanced Cardiovascular Life Support *329*
- Airway Management *329*
- Breathing (Ventilation) *331*
- Airway and Breathing for Patients with Cervical Spine *332*
- Circulation *332*
- Compression (C) to Ventilation (V) Ratio *333*
- Monitoring of CPR *333*
- Management of Arrhythmias Seen During Cardiac Arrest *333*
- Management of Nonshockable Rhythms *334*
- Newer Techniques/Variations in CPR *336*
- Postcardiac Arrest Care *337*
- Pediatric CPR (Excluding Newborn) *338*
- Newborn CPR *339*
- CPR in Pregnancy *339*
- Open Chest Massage *339*
- Complications of CPR *339*
- Outcome of CPR *339*
- Important Considerations in CPR *339*
- Summary of Changes as Per *2020* AHA Guidelines *341*
- Drugs for CPR *341*

Appendices

Appendix 1: Pressure Conversion And Miscellaneous.....345
- Conversion of Pressure *345*
- Drugs Metabolized by Plasma Cholinesterase (Pseudocholinesterase) *345*
- Drugs Metabolized by RBC Esterase *345*
- Methemoglobinemia *345*
- Agents Producing Convulsions *345*
- Antanalgesics *345*
- Contraindication of Bag and Mask Ventilation *345*

Appendix 2: Crash Cart
- Crash Cart and Holding Area *346*

Index 347