

CONTENT OUTLINE

JOINT COUNCIL ON IN-TRAINING EXAMINATIONS

AMERICAN BOARD OF ANESTHESIOLOGY

AMERICAN SOCIETY OF ANESTHESIOLOGISTS

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I. BASIC SCIENCES

A. ANATOMY

1. Topographical Anatomy as Landmarks

- a) Neck: Tracheotomy Site, Cricothyroid Membrane, Internal and External Jugular Veins, Thoracic Duct, Carotid and Vertebral Arteries, Stellate Ganglion, Cervical Spine Landmarks (Vertebra Prominens, Chassaignac's Tubercle)
- b) Chest: Pulmonary Lobes, Cardiac Landmarks, Subclavian Vein
- c) Pelvis and Back: Vertebral Level of Topographical Landmarks, Caudal Space
- d) Extremities: Relationship of Bones, Nerves, and Arteries

2. Radiological Anatomy

- a) Chest (Including CT and MRI); heart: angiography, nuclear imaging techniques
- b) Brain and Skull (Including CT and MRI)
- c) Spine (Cervical, Thoracic, Lumbar), Including CT and MRI
- d) Neck (Including Doppler Ultrasound for Central Venous Access)

B. PHYSICS, MONITORING, & ANESTHESIA DELIVERY DEVICES

1. Mechanics

- a) Pressure Measurement of Gases, Liquids
- b) Transducers, Regulators, Medical Gas Cylinders

2. Flow Velocity

- a) Viscosity-Density; Laminar-Turbulent Flow
- b) Flowmeters: Rotameter
- c) Principles of Doppler Ultrasound

3. Properties of Liquids, Gases, and Vapors

- a) Diffusion of Gases
- b) Solubility Coefficients
- c) Relative and Absolute Humidity
- d) Critical Temperature, Critical Pressure

4. Gas Laws

5. Vaporizers

- a) Vapor Pressure and Calculation of Anesthetic Concentrations
- b) Vaporizer Types and Safety Features

6. Uptake and Distribution of Inhalation Agents

- a) Uptake and Elimination Curves; Effect of Ventilation, Circulation, Anesthetic Systems
- b) Concentration Effect
- c) Second Gas Effect
- d) Nitrous Oxide and Closed Spaces

7. Physics of Anesthesia Machine/ Breathing System

- a) Principles: Resistance, Turbulent Flow, Mechanical Deadspace, Rebreathing, Dilution, Leaks, Gas Mixtures, Humidity, Heat
- b) Components: Connectors, Adaptors, Mask, Endotracheal Tube, Reservoir Bag, Unidirectional Valves, Corrugated Breathing Tubes, Laryngeal Mask Airways, Airway Pressure Relief Valve
- c) Characteristics
 - 1) circle systems: closed and semi-closed; adult; pediatric
 - 2) non-circle systems: insufflation; open; semi-open
 - 3) portable ventilation devices (self-reinflating, non-self-reinflating), non-rebreathing valves
 - 4) CO₂ absorption: principles, canisters, efficiency
 - 5) toxicity: Compound A, carbon monoxide
- d) Oxygen Supply Systems: FiO₂
- e) Waste Gas Evacuation Systems
- f) Safety Features (Proportioning Devices, Rotameter Configuration, Pressure Fail-Safe)
- g) Design/Ergonomics of Anesthesia Machines

8. Monitoring Methods

- a) Vascular Pressures: Arterial (Invasive/Noninvasive Differences), Central Venous (CVP), Pulmonary Arterial (PAP), Pulmonary Artery Occlusion (PAOP), Left Atrial (LAP), Left Ventricular End-Diastolic (LVEDP)
- b) Heart Function: Heart Tones, Electrocardiogram (ECG), Echocardiography, Doppler, Cardiac Output
- c) Brain and Spinal Cord Function: Electroencephalogram (EEG) (Raw and Processed), Depth of Anesthesia Monitors (Bispectral, Other), Evoked Potentials, Wake-Up Test, Intracranial Pressure (ICP), Jugular Venous Oxygen Saturation, Near Infrared Spectroscopy (Cerebral Oximetry), Transcranial Doppler
- d) Neuromuscular Function: Nerve Stimulators, Electromyography (EMG)
- e) Ventilation: Respirometers, Inspiratory Force, Spirometry, Flow-Volume Loops
- f) Gas Concentrations: O₂, CO₂, Nitrogen, Anesthetic Gases and Vapors
- g) Temperature
- h) Oxygen: Oximetry, CO-oximetry, Pulse Oximetry, Mixed Venous Oxygen Saturation (SvO₂)

9. Instrumentation

- a) Blood Gases: Electrodes for pH, PO₂, PCO₂, Calibration, Temperature Corrections, Errors
- b) Gas Concentrations: Infrared Absorption, Mass Spectrometry, Raman Scatter Analysis

- c) Cardiac Output: Fick, Dye Dilution, Thermodilution, Doppler, Impedance
- d) Pressure Transducers: Resonance, Damping
- e) Non-Invasive Blood Pressure (BP) Measurement: Doppler, Oscillometry, Korotkoff Sounds, Palpation
- f) Blood Warmers, Autotransfusion Devices
- g) Echocardiography: Technical Aspects, Complications
- h) Coagulation Monitors
- i) Ultrasound-Guided Placement of Invasive Catheters (Arterial, Central Venous) and Nerve Blocks
- j) Body Warming Devices: Forced Air, Heating Lamps, Insulation Devices, Warming Blankets, Water-Flow “Second Skin” Devices

10. Ventilators

- a) Classifications: Flow Generation vs. Pressure Generation
- b) Principles of Action: Assistors, Controllers, Assist-Control; Pressure-Limited, Volume-Limited; FIO₂ Control; Periodic Sigh, Inverse Ratio, High Frequency Ventilation, Intermittent Mandatory Ventilation (IMV), Synchronized IMV, Pressure Support, Airway Pressure Release Ventilation (APRV), Pediatric Adaptation, Non-Invasive Techniques: Biphasic Positive Airway Pressure (BIPAP), Others
- c) Monitors; Pressure (Plateau, Peak), Oxygen, Apnea, Inspiratory/Expiratory Ratio, Dynamic Compliance, Static Compliance
- d) Continuous Positive Airway Pressure (CPAP) and Positive End-expiratory Pressure (PEEP); Nasal CPAP and BIPAP
- e) Nebulizers, Humidifiers, Drug Delivery Systems (Nitric Oxide, Others)

11. Alarms: Operating Room, Electrical, Anesthesia Machine, Ventilators, Capnometer, Oxygen

12. Defibrillators: Automatic Internal, External, Implantable; Energy, Cardioversion, Types of Waveforms (Monophasic, Biphasic); Paddle Size and Position; Automated External Defibrillators (AEDs)

13. Pacemakers

- a) Temporary Transvenous; Permanent (Epicardial, Endocardial), Transcutaneous
- b) Types: Fixed Rate, Biventricular Synchronized, Ventricular, Atrial, Atrio-ventricular (A-V) Sequential
- c) Standard Nomenclature
- d) Reasons for Failure or Malfunction

14. Electrical; Fire and Explosion Hazards; Basic Electronics

- a) Source of Ignition; Static
- b) Prevention: Grounding, Isolation Transformers
- c) Macro and Micro Current Hazards

- d) Safety Regulations; National Fire Protection Association (NFPA) Standards
- e) Lasers, Laser Safety, Laser-safe Endotracheal Tubes
- f) Airway Fires

15. Drug Delivery Devices: Patient-Controlled Intravenous and Epidural Analgesia, Epidural and Subarachnoid Continuous Drug Delivery Devices

C. MATHEMATICS

1. Simple Math: Logarithms; Graph of Simple Equations; Exponential Function, Analysis of Biologic Curves

2. Statistics: Sample and Population; Probability; Mean, Median, and Mode; Standard Deviation and Error; T-Test; Chi-Square; Regression Analysis/Correlation; Analysis of Variance, Power Analysis, Meta-Analysis, Confidence Limits, Odds Ratio, Risk Ratio

3. Computer: Data Handling, Processing, and Analysis

- a) Basic Computer Knowledge: Programs vs. Operating System, Computer Virus, Disk or Central Processing Unit (CPU) Failure, Amplifiers, Microprocessors

D. PHARMACOLOGY

1. General Concepts

- a) Pharmacokinetics and Pharmacodynamics, Protein Binding; Partition Coefficients; pKa; Ionization; Tissue Uptake; Compartmentalization and Exponential Models
 - 1) pharmacokinetics of neuraxial drug administration: epidural and subarachnoid
 - 2) tolerance and tachyphylaxis
- b) Termination of Action
 - 1) elimination, biotransformation; context-sensitive half-time
 - 2) impact of renal disease
 - 3) impact of hepatic disease
- c) Drug Interactions: Enzyme Induction and Inhibition, Hepatic Blood Flow, Drug-Drug Binding
 - 1) alternative and herbal medicines: perioperative implications
- d) Drug Reactions (Anaphylactoid, Anaphylaxis, Idiosyncratic)
- e) Pharmacogenetics
 - 1) malignant hyperthermia (including diagnosis and therapy)
 - 2) pseudocholinesterase deficiency
 - 3) prolonged QT syndrome
 - 4) genetic factors in drug dose-response relationships
- f) Addiction
 - 1) physiology and pharmacology
 - 2) patient addiction: anesthetic implications
 - 3) addiction among health care workers and anesthesiologists

2. Anesthetics-Gases and Vapors

- a) Physical Properties
- b) Mechanism of Action
- c) Effects on Central Nervous System (CNS)
- d) Effects on Cardiovascular System
- e) Effects on Respiration
- f) Effects on Neuromuscular Function
- g) Effects on Renal Function
- h) Effects on Hepatic Function
- i) Effects on Hematologic and Immune Systems
- j) Biotransformation and Toxicity
- k) Minimum Alveolar Concentration (MAC), Factors Affecting MAC
- l) Trace Concentrations, OR Pollution, Personnel Hazards
- m) Comparative Pharmacodynamics

3. Anesthetics-Intravenous (Opioid and Non-Opioid Induction and Anesthetic Agents)

- a) Opioids
 - 1) mechanism of action
 - 2) pharmacokinetics and pharmacodynamics
 - (a) intravenous
 - (b) epidural and intrathecal
 - 3) metabolism and excretion
 - 4) effect on circulation
 - 5) effect on respiration
 - 6) effect on other organs
 - 7) side effects and toxicity
 - 8) indications and contraindications
- b) Barbiturates
 - 1) mechanism of action
 - 2) pharmacokinetics and pharmacodynamics
 - 3) metabolism and excretion
 - 4) effect on circulation
 - 5) effect on respiration
 - 6) effect on other organs
 - 7) side effects and toxicity
 - 8) indications and contraindications
- c) Propofol
 - 1) mechanism of action
 - 2) pharmacokinetics and pharmacodynamics
 - 3) metabolism and excretion
 - 4) effect on circulation
 - 5) effect on respiration
 - 6) effect on other organs

- 7) side effects and toxicity
- 8) indications and contraindications
- d) Etomidate
 - 1) mechanism of action
 - 2) pharmacokinetics and pharmacodynamics
 - 3) metabolism and excretion
 - 4) effect on circulation
 - 5) effect on respiration
 - 6) effect on other organs
 - 7) side effects and toxicity
 - 8) indications and contraindications
- e) Benzodiazepines
 - 1) mechanism of action
 - 2) pharmacokinetics and pharmacodynamics
 - 3) metabolism and excretion
 - 4) effect on circulation
 - 5) effect on respiration
 - 6) effect on other organs
 - 7) side effects and toxicity
 - 8) indications and contraindications

4. Anesthetics - Local

- a) Uptake, Mechanism of Action
- b) Biotransformation and Excretion
- c) Comparison of Drugs and Chemical Groups
- d) Prolongation of Action
- e) Side Effects and Toxicity
 - 1) CNS : seizures, cauda equina syndrome, transient neurological symptoms
 - 2) cardiac
 - 3) allergy
 - 4) preservatives/additives
 - 5) maternal-fetal

5. Muscle Relaxants (Depolarizing, Non-Depolarizing)

- a) Mechanism of Action
- b) Pharmacokinetics and Pharmacodynamics, Abnormal Responses
- c) Prolongation of Action; Synergism
- d) Metabolism and Excretion
- e) Side Effects and Toxicity
- f) Indications and Contraindications
- g) Antagonism of Blockade
- h) Drug Interactions (Antibiotics, Antiepileptics, Lithium, Magnesium, Inhalational Anesthetics)

II. CLINICAL SCIENCES

A. ANESTHESIA PROCEDURES, METHODS, AND TECHNIQUES

1. Evaluation of the Patient and Preoperative Preparation

- a) Laboratory Evaluation
 - 1) American Society of Anesthesiologists (ASA) Preoperative Testing Guidelines
 - 2) American College of Cardiology/American Heart Association Guidelines for Perioperative Cardiovascular Evaluation
- b) Premedication
 - 1) interaction with chronic drug therapy; interaction with anesthetic agents
 - 2) adverse reactions to premedications; patient variability, dose response curves, side effects
 - 3) specific problems in disease states: hyperthyroidism and hypothyroidism, drug abuse, glaucoma, uremia, increased CSF pressure, chronic steroid ingestion, obesity, depression, COPD, hypertension
 - 4) pediatric and geriatric doses, routes of administration
 - 5) role in patients with allergies
 - 6) alteration of gastric fluid volume and pH, gastroesophageal and pyloric gastroesophageal reflux disease (GERD), sphincter tone
 - 7) continuation vs. discontinuation of chronic medications: antihypertensives, anti-anginal, antihyperglycemics, antidepressants, platelet inhibitors, etc.
 - 8) prophylactic cardiac risk reduction: beta-adrenergic blockers, etc.
- c) Physical Examination, Airway Evaluation
- d) NPO Status, Full Stomach and Induction of Anesthesia
- e) ASA Physical Status Classification

2. Regional Anesthesia

- a) General Topics: Premedication, Patient Position, Equipment, Monitoring and Sedation
- b) Spinal, Epidural, Caudal, Combined Spinal/Epidural
 - 1) indications, contraindications, techniques, complications, comparison of techniques
 - 2) sites of actions
 - 3) factors influencing onset, duration, and termination of action
 - 4) systemic toxicity, test dose
 - 5) complications: precipitating factors, prevention, therapy, implications of anticoagulants and platelet inhibitors: American Society of Regional Anesthesia and Pain Medicine (ASRA) guidelines

- c) Peripheral and Autonomic Nerve Blocks: Indications, Contraindications, Techniques, Clinical Assessment, Complications, Use of Nerve Stimulators
 - 1) head and neck
 - 2) upper extremity/brachial plexus
 - 3) trunk and perineum
 - 4) lower extremity
- d) IV Regional: Mechanism, Agents, Indications, Contraindications, Techniques, Complications

3. General Anesthesia

- a) Stages and Signs of Anesthesia; Awareness Under Anesthesia
- b) Techniques: Inhalational, Total Intravenous, Combined Inhalational/Intravenous
- c) Airway Management
 - 1) assessment/identification of difficult airway: anatomic correlates, Mallampati classification, range of motion
 - 2) techniques for managing airway: awake vs. asleep, use vs. avoidance of muscle relaxants, drug selection, retrograde intubation techniques, ASA Difficult Airway Algorithm
 - 3) devices: flexible fiberoptic, rigid fiberoptic, transillumination, laryngoscope blades, Bullard laryngoscope
 - 4) alternatives and adjuncts: laryngeal mask airway (traditional and modified), esophageal obturator airways, occlusive pharyngeal airways
 - 5) transcutaneous or surgical airway: tracheostomy, cricothyroidotomy, translaryngeal or transtracheal jet ventilation
 - 6) endobronchial intubation: double-lumen endobronchial tubes; bronchial blockers (integral to endotracheal tube or separate), placement and positioning considerations, postoperative considerations
 - 7) intubation and tube change adjuncts: gum-elastic bougies, jet stylettes, soft and rigid tube change devices; complications

4. Monitored Anesthesia Care and Sedation: ASA Guidelines for Sedation, Sedation Guidelines for Non-Anesthesiologists

5. Intravenous Fluid Therapy During Anesthesia: Water, Electrolyte, Glucose Requirements and Disposition, Crystalloid Vs. Colloid

6. Complications (Etiology, Prevention, Treatment)

- a) Trauma
 - 1) upper airway, epistaxis
 - 2) larynx, trachea, and esophagus
 - 3) eyes: corneal abrasions, blindness
 - 4) vascular; arterial and venous thrombosis; thrombophlebitis; sheared catheter, intra-arterial injections, air embolism, cardiac/vascular perforations, pulmonary artery rupture

- 5) neurological: pressure injuries of mask, tourniquet, body position, intraneural injections, retractors, peripheral neuropathies, ASA Patient Positioning Guidelines
- 6) burns
- b) Chronic Environmental Exposure; Fertility, Teratogenicity, Carcinogenicity, Scavenging
- c) Temperature
 - 1) hypothermia: etiology, prevention, treatment, complications (shivering, O₂ consumption), prognosis
 - 2) nonmalignant hyperthermia; complications, treatment
- d) Bronchospasm; Anaphylaxis
 - 1) latex allergy
- e) Laryngospasm
- f) Postobstructive Pulmonary Edema

7. Special Techniques

- a) Controlled Hypotension; Choice of Drugs, Use of Posture, Ventilation
- b) Controlled Hypothermia; Techniques, Systemic Effects, Shivering, Rewarming, Complications
- c) Hyperbaric Oxygen and Anesthesia Care
- d) High Altitude Anesthesia

8. Postoperative Period

- a) Pain Relief
 - 1) pharmacologic
 - (a) drugs: opioids, agonist-antagonists, local anesthetics, alpha-2 agonists, nonsteroidal anti-inflammatory drugs (NSAIDs), N-Methyl-D-Aspartate (NMDA) receptor blockers
 - (b) routes: oral, rectal, subcutaneous (SC), transcutaneous, transmucosal, intramuscular (IM), intravenous (IV), including patient-controlled analgesia (PCA), epidural, spinal, intrapleural, other regional techniques
 - (c) risks and benefits, complications
 - 2) other techniques; Transcutaneous Electrical Nerve Stimulation (TENS); cryotherapy; acupuncture, hypnosis
- b) Respiratory Consequences of Anesthesia and of Surgical Incisions
- c) Cardiovascular Consequences of General and Regional Anesthesia: Differential Diagnosis and Treatment of Postoperative Hypertension and Hypotension
- d) Neurologic Consequences of Anesthesia: Confusion, Delirium, Cognitive Dysfunction
- e) Nausea and Vomiting; Aspiration
 - 1) Prevention and treatment: use of antacids, Histamine 2 (H₂) blockers, metoclopramide, transdermal scopolamine, droperidol, serotonin antagonists, proton inhibitors, dexamethasone, multimodal therapy, acupuncture/acupressure

- 2) pulmonary aspiration of gastric contents

III. ORGAN-BASED BASIC AND CLINICAL SCIENCES

A. RESPIRATORY SYSTEM

1. Physiology

- a) Respiration: Lung Functions and Cellular Processes
 - 1) lung volumes
 - (a) definitions; methods of measurement; normal values; time constants
 - (b) spirometry; static and dynamic volumes; deadspace; nitrogen washout, O₂ uptake, CO₂ production, exercise testing
 - 2) lung mechanics
 - (a) static and dynamic compliance, pleural pressure gradient, flow-volume loops and hysteresis, surfactant, LaPlace Law
 - (b) resistances; principles of gas flow measurement
 - (c) methods of measurement
 - (d) work of breathing
 - (e) regulation of airway caliber
 - 3) ventilation - perfusion
 - (a) distribution of ventilation
 - (b) distribution of perfusion, zones, hypoxic pulmonary vasoconstriction
 - (c) measurement of Ventilation/Perfusion (V/Q) ratio, implications of Alveolar-arterial O₂ gradient (A-aDO₂), arterial-Alveolar CO₂ gradient (a-ADCO₂), Dead Space to Tidal Volume Ratio (V_d/V_t), Shunt Fraction (Q_s/Q_t), lung scan
 - 4) diffusion
 - (a) definition, pulmonary diffusion capacity
 - (b) apneic oxygenation, diffusion hypoxia
 - 5) blood gas transport
 - (a) O₂ transport; O₂ physical solubility; oxyhemoglobin (Hb-O₂) saturation, Hb-O₂ dissociation curve; 2,3-diphosphoglycerate (2,3-DPG), P₅₀, respiratory enzymes; hemoglobin (Hb) as a buffer
 - (b) CO₂ transport; blood CO₂ content; carbonic anhydrase; CO₂ dissociation curve; Bohr effect, Haldane effect
 - (c) systemic effects of hypercarbia and hypocarbia
 - (d) systemic effects of hyperoxia and hypoxemia
 - 6) regulation of ventilation
 - (a) respiratory center

- (b) central and peripheral chemoreceptors; proprioceptive receptors; respiratory muscles and reflexes; innervation
- (c) CO₂ and O₂ response curves
- 7) non-respiratory functions of lungs: metabolic, immune

2. Anatomy

- a) Nose
- b) Pharynx: Subdivisions; Innervation
- c) Larynx
 - 1) innervation; muscles; blood supply; cartilages
 - 2) vocal cords, positions with paralysis
 - 3) differences between infant and adult
- d) Trachea
 - 1) structure and relationships in neck and chest
- e) Lungs
 - 1) divisions and bronchoscopic anatomy
 - 2) bronchial and pulmonary circulations
 - 3) microscopic anatomy
- f) Muscles of Respiration, Accessory Muscles

3. Biochemistry

- a) Normal Acid-Base Regulation: Buffer Systems; Compensatory Mechanisms; Effects of Imbalance on Electrolytes and Organ Perfusion; Strong Ionic Difference (SID)
 - 1) temperature effect on blood gases: alpha-stat vs. pH-stat

4. Clinical Science

- a) Respiratory System
 - 1) obstructive disease
 - (a) upper airway: congenital, infectious, neoplastic, traumatic, foreign body, obstructive sleep apnea
 - (b) tracheobronchial: congenital, infectious, neoplastic, traumatic, foreign body
 - (c) parenchymal: asthma, bronchitis, emphysema, lung abscess, bronchiectasis, cystic fibrosis, mediastinal masses
 - 2) restrictive disease
 - (a) neurologic: CNS depression, spinal cord dysfunction, peripheral nervous system
 - (b) musculoskeletal: muscular, skeletal, obesity, chest trauma
 - (c) parenchymal: atelectasis, pneumonia, interstitial pneumonitis, pulmonary fibrosis, respiratory distress syndrome (ARDS), bronchopulmonary dysplasia
 - (d) pleural and mediastinal: pneumo-, hemo-, and chylothorax, pleural effusion, empyema, bronchopleural fistula
 - (e) other: pain, abdominal distention

- 3) management of the patient with respiratory disease
 - (a) evaluation: history and physical examination, Chest X-ray, Arterial Blood Gases (ABGs), Pulmonary Function Tests (PFTs); assessment of perioperative risk
 - (b) anesthetic management
 - (1) preoperative preparation: respiratory therapy, drug therapy (antibiotics, bronchodilators, mucolytics, steroids)
 - (2) intraoperative management
 - (a) monitoring
 - (b) choice of anesthesia
 - (c) anesthetic techniques: nonpulmonary surgery, thoracic and pulmonary surgery, one-lung ventilation, lung transplantation, thoroscopic surgery
 - (3) postoperative care: pain management, respiratory therapy, ventilator support, extubation criteria
 - (c) management of respiratory failure
 - (1) nonventilatory respiratory management: O₂ therapy and toxicity, tracheobronchial toilet, positive airway pressure, respiratory drugs
 - (2) ventilatory management
 - (a) criteria for ventilatory commitment and weaning
 - (b) mode of ventilation: conventional mechanical ventilation, PEEP, CPAP, IMV, SIMV, pressure support, pressure control, high frequency ventilation (positive pressure, jet, oscillation), prone ventilation, BIPAP
 - (c) complications and side effects of mechanical ventilation: volutrauma, barotrauma
 - (3) other management adjuncts: nitric oxide, steroids
 - (4) lung transplantation: anesthetic implications

B. CARDIOVASCULAR SYSTEM

1. Physiology

- a) Cardiac Cycle
 - 1) control of heart rate
 - 2) synchronicity of pressure, flow, ECG, sounds, valve action
 - 3) impulse propagation
 - 4) normal ECG
 - 5) electrophysiology; ion channels and currents
- b) Ventricular Function
 - 1) Frank-Starling law; preload and afterload, intracardiac pressures
 - 2) force, velocity, length, rate of shortening
 - 3) myocardial contractility, measurement limitations
 - 4) cardiac output: determinants and regulation
 - 5) myocardial oxygen utilization
 - 6) systolic and diastolic function

- c) Venous Return
 - 1) vascular compliance/venous capacitance; controlling factors
 - 2) muscle action; intrathoracic pressure; body position
 - 3) blood volume and distribution
- d) Blood Pressure
 - 1) systolic, diastolic, mean, and perfusion pressures
 - 2) intracardiac, pulmonary, venous
 - 3) systemic and pulmonary vascular resistance, viscosity
 - 4) baroreceptor function
- e) Microcirculation
 - 1) capillary diffusion; osmotic pressure, Starling's Law
 - 2) pre-post capillary sphincter control
 - 3) viscosity; rheology
- f) Regional Blood Flow and Its Regulation
 - 1) cerebral and spinal cord
 - 2) coronary
 - 3) pulmonary
 - 4) renal
 - 5) splanchnic - hepatic
 - 6) muscle and skin
 - 7) uterine and placental
- g) Regulation of Circulation and Blood Volume
 - 1) central: vasomotor center, hypothalamic-pituitary-adrenal axis
 - 2) peripheral: receptors and reflexes
 - 3) hormonal control
 - 4) mixed venous oxygen tension and saturation

2. Anatomy

- a) Normal Anatomy of Heart and Major Vessels
 - 1) echocardiographic heart anatomy: chambers, valves, great vessels, pericardium, basic transesophageal echocardiography (TEE) views, MRI
- b) Coronary Circulation
 - 1) heart conduction system; innervation
 - 2) blood supply of other major organs

3. Pharmacology

- a) Digitalis; Actions and Toxicity
- b) Positive Inotropes
- c) Phosphodiesterase III Inhibitors (Inodilators): Milrinone, Others
- d) Antiarrhythmics
- e) Antianginal Drugs
- f) Direct Vasodilators: Nitroprusside, Nitroglycerin, Hydralazine, Nesiratide, etc.

- g) Angiotensin Converting Enzyme Inhibitors and Angiotensin Blockers
- h) Electrolytes (Potassium, Magnesium, Phosphorus, Calcium): Cardiovascular Effects
- i) Non-Adrenergic Vasoconstrictors: Vasopressin and Congeners

4. Clinical Sciences

- a) Ischemic Heart Disease
 - 1) risk factors; predictors of perioperative risk, modification of perioperative risk (e.g., prophylactic beta-blockers)
 - 2) manifestations
 - 3) diagnosis of myocardial infarction; clinical, ECG, enzymes, echocardiography, nuclear techniques
 - 4) pharmacological treatment of angina, thoracic epidural for angina, interventional cardiologic techniques
 - 5) determinants of myocardial oxygen requirements and delivery, silent ischemia, postoperative ischemia
 - 6) perioperative diagnosis and treatment of ischemia; ECG, TEE
 - 7) coronary artery bypass procedures; cardiopulmonary bypass; off-pump and other minimally invasive techniques
- b) Valvular Heart Disease
 - 1) classification
 - 2) diagnosis, natural history, surgical management
 - 3) anesthetic considerations, minimally invasive techniques
 - 4) subacute bacterial endocarditis prophylaxis
- c) Rhythm Disorders and Conduction Defects
 - 1) electrophysiology
 - 2) chronic abnormalities: etiology, diagnosis, therapy
 - (a) Automated Implantable Cardioverter/Defibrillator (AICD) implantation
 - (b) pacemakers: permanent, temporary, transvenous, transcutaneous; ventricular synchronization
 - (c) ablations, cryotherapy, Maze procedure
 - 3) intraoperative dysrhythmia: etiology, diagnosis, therapy
 - 4) perioperative implications of pacemaker and AICD
- d) Heart Failure and Cardiomyopathy (Ischemic, Viral, Hypertrophic)
 - 1) definition and functional classification
 - 2) compensatory responses
 - 3) right or left ventricular dysfunction
 - (a) etiology
 - (b) signs and symptoms
 - (c) diagnostic tests
 - (d) systolic vs. diastolic dysfunction
 - 4) treatment
 - (a) pulmonary edema

- (b) pulmonary hypertension
 - (c) cardiogenic shock
- 5) cardiac transplantation
- e) Cardiac Tamponade and Constrictive Pericarditis
 - 1) etiology
 - 2) diagnosis; TEE, PA catheter
 - 3) anesthetic management
- f) Circulatory Assist
 - 1) cardiopulmonary bypass
 - (a) components (pump, oxygenator, heat exchanger, filters)
 - (b) cardiopulmonary bypass techniques
 - (c) mechanisms of gas exchange
 - (d) priming solutions, hemodilution
 - (e) anticoagulation and antagonism; Activated Clotting Time (ACT) and other clotting times, heparin assays, antithrombin III, protamine reactions, heparin and protamine alternatives
 - (f) prophylaxis with aminocaproic acid, tranexamic acid, and aprotinin
 - (g) anesthetic considerations during bypass
 - (h) extracorporeal membrane oxygenation (ECMO)
 - (i) cooling and warming, deep hypothermic circulatory arrest
 - (j) monitoring, blood pressure management
 - (k) minimally invasive bypass techniques
 - (l) myocardial preservation: physiology, techniques, complications
 - (m) preconditioning
 - 2) intraaortic balloon: rationale, indications, limitations
 - 3) ventricular assist devices and artificial heart: internal and external
- g) Pulmonary Embolism
 - 1) etiology: blood, air, fat, amniotic fluid
 - 2) diagnosis, TEE findings
 - 3) treatment; acute, preventive
- h) Hypertension
 - 1) etiology, pathophysiology, course of disease
 - 2) drug treatment, interactions with anesthetics, risk of anesthesia
 - 3) intraoperative or postoperative hypertension
 - (a) differential diagnosis and treatment
- i) Peripheral Circulatory Failure
 - 1) etiology, classification, pathophysiology
 - 2) anesthetic management of patient in shock
 - 3) sepsis, Systemic Inflammatory Response Syndrome (SIRS), multiple organ failure (MOF)
- j) Vascular Diseases
 - 1) cerebral circulation; luxury perfusion, steals, infarcts, intracranial hemorrhage

- 2) carotid endarterectomy: anesthetic management, monitoring of cerebral perfusion, complications
 - 3) abdominal aneurysm resection: anesthetic management
 - 4) peripheral arteriosclerotic disease
 - 5) aneurysms of ascending, descending and arch of aorta, thoracoabdominal aneurysms
 - (a) endovascular repair techniques
- k) Cardiopulmonary Resuscitation
- 1) recognition
 - 2) management - drugs, defibrillators, monitors, Advanced Cardiac Life Support (ACLS) guidelines
 - 3) complications of therapy
 - 4) pediatric/adult differences

C. CENTRAL AND PERIPHERAL NERVOUS SYSTEMS

1. Physiology

- a) Brain
 - 1) cerebral cortex; functional organization
 - 2) subcortical areas: basal ganglia, hippocampus, internal capsule, cerebellum, brain stem, reticular activating system
 - 3) Electroencephalography (EEG)
 - (a) wave patterns, frequency and amplitude, raw and processed, spectral edge
 - (b) sleep, convulsions; O_2 and CO_2 ; hypothermia; brain death
 - (c) depth of anesthesia; burst suppression, electrical silence, specific anesthetic and drug effects
 - 4) evoked responses
 - (a) morphology, effects of ischemia and anesthetics
 - (b) sensory: somatosensory, visual, brainstem auditory
 - (c) motor
 - 5) intracranial pressure
 - (a) brain volume, elastance and compliance
 - (b) increased ICP, herniation
 - 6) metabolism: substrates, aerobic and anaerobic
 - 7) cerebral blood flow
 - (a) effect of perfusion pressure, pH, $PaCO_2$, PaO_2 , and Cerebral Metabolic Rate for O_2 ($CMRO_2$); inverse steal; gray vs. white matter
 - (b) autoregulation: normal, altered, and abolished
 - (c) pathophysiology of ischemia/hypoxia: global vs. focal, glucose effects, effects of brain trauma or tumors
 - 8) cerebrospinal fluid
 - (a) formation, volume, composition, flow and pressure
 - (b) blood-brain barrier, active and passive molecular transport across, causes of disruption
 - (c) relation to blood composition and acid-base balance

- 9) cerebral protection
 - (a) hypothermia
 - (b) anesthetic and adjuvant drugs
- b) Spinal Cord
 - 1) general organization
 - 2) spinal reflexes
 - 3) spinal cord tracts
 - 4) evoked potentials
- c) Cerebrospinal Fluid
 - 1) formation, volume, composition, flow and pressure
 - 2) blood brain barrier
 - 3) brain volume, compliance
 - 4) relation to blood chemistry and acid-base balance
- d) Neuromuscular and Synaptic Transmission
 - 1) morphology; receptors, receptor density
 - 2) membrane potential; mechanism
 - 3) action potential; characteristics, ion flux
 - 4) synapse; transmitters, precursors, ions, termination of action, transmission characteristics, presynaptic and postsynaptic functions
- e) Skeletal Muscle Contractions; Depolarization, Role of Calcium, Actin, Myosin; Energy Source and Release
- f) Pain Mechanisms and Pathways
 - 1) nociceptors and nociceptive afferent neurons, wind-up phenomenon
 - 2) dorsal horn transmission and modulation
 - 3) spinal and supraspinal neurotransmission and modulation; opioid receptors
 - 4) autonomic contributions to pain; visceral pain perception and transmission
 - 5) social, vocational and psychological influences on pain perception
 - 6) gender and age differences in pain perception
- g) Autonomic Nervous System
 - 1) sympathetic: receptors; transmitters, synthesis; storage; release; responses; termination of action
 - 2) parasympathetic: receptors; transmitters; synthesis; release; responses; termination of action
 - 3) ganglionic transmission
 - 4) reflexes: afferent and efferent limbs
- h) Temperature Regulation
 - 1) temperature sensing; central, peripheral
 - 2) temperature regulating centers; concept of set point
 - 3) heat production and conservation
 - 4) heat loss; mechanisms
 - 5) body temperature measurement; sites; gradients

- 6) effect of drugs/anesthesia on temperature regulation
- 7) special pediatric considerations

2. Anatomy

- a) Brain
 - 1) cerebral cortex
 - (a) cerebellum, basal ganglia, major nuclei and pathways
 - (b) brain stem
 - (1) respiratory centers
 - (2) reticular activating system
 - (c) cerebral circulation; Circle of Willis, venous sinuses and drainage
- b) Spinal Cord and Spine
 - 1) variations in vertebral configurations
 - 2) spinal nerves (level of exit, covering, sensory distribution)
 - 3) blood supply
 - 4) sacral nerves: innervation of pelvic structures
- c) Meninges: Epidural, Subdural and Subarachnoid Spaces
- d) Parasympathetic Nervous System: Location of Ganglia, Vagal Reflex Pathways
- e) Sympathetic Nervous System: Ganglia, Rami Communicantes, Sympathetic Chain
 - 1) cranial nerves
 - 2) carotid and aortic bodies, carotid sinus
 - (a) nociception
 - (b) peripheral nociceptors: transduction
 - (c) afferent pathways: neurons, dorsal horn, CNS pathways
- f) Regional Anesthesia; Main Nerve Blocks
 - 1) autonomic: stellate, celiac, lumbar sympathetic
 - 2) head and neck: retrobulbar/peribulbar, facial, trigeminal nerve and branches, cervical plexus, glossopharyngeal, superior laryngeal, transtracheal, occipital
 - 3) extremities: brachial plexus (interscalene, supraclavicular, infraclavicular, axillary), ulnar, radial, median, musculocutaneous, sciatic, femoral, lateral femoral cutaneous, obturator, lumbar plexus (psoas block), popliteal fossa, ankle block
 - 4) trunk: intercostal, paravertebral somatic, ilio-inguinal, genito-femoral
 - 5) spine: epidural (cervical, thoracic, lumbar, caudal, transforaminal), spinal (subarachnoid), combined spinal-epidural, facet

3. Pharmacology

- a) CNS Drugs for Non-Anesthetic Use (Major Actions, Comparison of Drugs; Effect on Respiration; Circulation, Adverse Effects)
 - 1) pre- and postanesthetic medications
 - a) opioids

- b) opioid antagonists, agonist-antagonists
- 2) alpha-2 agonists: clonidine, dexmedetomidine
- 3) tranquilizers: butyrophenones; benzodiazepines
- 4) anticonvulsants: phenytoin, carbamazepine, gabapentin, barbiturates, others
- 5) antidepressants, anti-Parkinson drugs
- 6) arousal agents: physostigmine, benzodiazepine antagonists
- 7) antiemetics and aspiration prophylaxis: phenothiazines; butyrophenones; metoclopramide; anticholinergics; serotonin antagonists, antihistamines (H1 blockers, H2 blockers, mixed blockers), antacids, proton pump inhibitors
- 8) drug abuse and addiction; dependence
 - a) chronic opioid dependence and therapy
 - b) pharmacologically-assisted opioid withdrawal
- b) Autonomic Drugs
 - 1) sympathetic
 - a) transmitters and types of receptors
 - b) target organ effects; metabolic effects
 - c) agonists: peripheral and central actions, direct and indirect actions, alpha vs. beta vs. mixed agonists, alpha and beta-receptor subtype-selective agonists
 - d) antagonists: alpha and beta blockers, selective blockers, ganglionic blockers
 - e) tocolytic applications
 - 2) parasympathetic
 - a) transmitters
 - b) muscarinic effects
 - c) nicotinic effects
 - d) agonists: cholinergic and anticholinesterases
 - e) antagonists

4. Clinical Science

- a) Central Nervous System
 - 1) seizures
 - 2) coma: traumatic, infectious, toxic-metabolic, cerebrovascular accident (CVA), cerebral hypoxia
 - a) Glasgow Coma Scale, management of traumatic brain injury
 - b) therapeutic barbiturate coma
 - 3) drug intoxication (CNS drugs, carbon monoxide, insecticides, nerve gases)
 - 4) paraplegia, quadriplegia, spinal shock, autonomic hyperreflexia
 - 5) neuromuscular diseases
 - 6) tetanus
 - 7) special problems of anesthesia for neurosurgery
 - a) increased intracranial pressure: tumors, hematomas, hydrocephalus
 - b) positioning: prone, sitting, other, head stabilization in tongs

- c) air embolism
- d) cerebral protection from hypoxia, ischemia, glucose effects
- e) aneurysms and A-V malformations, cerebral vasospasm
- f) interventional neuroradiology; coils and embolization
- g) pituitary adenomas, trans-sphenoidal hypophysectomy
- h) anesthetic and ventilatory effects on cerebral blood flow and metabolism
- i) fluid management: hypertonic vs isotonic saline vs. balanced salt solutions
- j) spinal fluid drainage
- k) stereotactic and gamma-knife techniques, deep brain stimulator placement, intra-operative wake-up techniques
- l) ventriculostomy

D. GASTROINTESTINAL / HEPATIC

1. Physiology

- a) Hepatic Function
 - 1) dual blood supply and its regulation
 - 2) metabolic and synthetic functions
 - 3) excretory functions
 - 4) mechanisms of drug metabolism and excretion, cytochrome P450

2. Biochemistry

- a) Nutrition
 - 1) parenteral: peripheral or central vein, hyperalimentation, solutions used and complications, anesthetic implications
 - 2) enteral: GI elemental diets, routes of delivery, complications, anesthetic implications

3. Clinical Science

- a) Morbid Obesity/Anesthesia for Bariatric Surgery
 - 1) preanesthetic evaluation and management
 - 2) pharmacologic considerations
 - 3) anesthetic management (airway, ventilation, monitoring, venous access)
 - 4) postoperative management (ventilation, analgesia)
- b) Hepatic Disease
 - 1) preoperative laboratory assessment
 - 2) anesthesia choice (hepatocellular disease, ascites, portal hypertension)
 - 3) postoperative hepatic dysfunction, hepatorenal syndrome
 - 4) hepatic transplantation

- c) Intestinal Obstruction
 - 1) causes; paralytic ileus; mechanical; vascular
 - 2) physiological changes; fluid and electrolyte; respiratory
 - 3) anesthesia management: full stomach; fluid therapy; nitrous oxide

E. RENAL / URINARY

1. Physiology

- a) Blood Flow, Glomerular Filtration, Tubular Reabsorption and Secretion
- b) Renal Function Tests
- c) Hormonal Regulation of Extracellular Fluid
- d) Hormonal Regulation of Osmolality
- e) Regulation of Acid-Base Balance
- f) Drug Excretion
- g) Water and Electrolytes: Distribution and Balance; Compartments

2. Pharmacology

- a) Diuretics
 - 1) mechanism of action
 - 2) comparison of drugs
 - 3) effect on electrolytes and acid-base balance
 - 4) adverse effects

3. Clinical Science

- a) Renal Disease
 - 1) pathophysiology of renal disease; risk factors for acute renal failure
 - 2) anesthetic choice in reduced renal function
 - 3) anesthetic management in renal failure, arteriovenous (A-V) shunts
 - 4) anesthetic management in renal transplantation
 - 5) perioperative oliguria and anuria
 - 6) dialysis and hemofiltration: hemodialysis, peritoneal dialysis, continuous hemofiltration (arteriovenous, venovenous)
 - 7) pharmacologic prevention and treatment of renal failure: osmotic and loop-acting diuretics, low-dose dopamine, fenoldopam
- b) Urologic Surgery - Lithotripsy, Transurethral Resection of Prostate (TURP)/Irrigating Fluids/Hyponatremia

F. ENDOCRINE / METABOLIC

1. Physiology

- a) Hypothalamus, Pituitary; Thyroid; Parathyroid, Adrenal Medulla, Adrenal Cortex and Pancreas

2. Biochemistry

- a) Normal Body Metabolism
 - 1) carbohydrates
 - (a) aerobic and anaerobic utilization; chemical processes, enzymes
 - (b) relationship to hormones; insulin; human growth hormone, glucocorticoids; glucagon, epinephrine
 - (c) effect of stress
 - 2) proteins
 - (a) functions, hormones, antibodies
 - (b) cyclic adenosine monophosphate (cAMP); cyclic guanosine monophosphate (c)GMP
 - (c) lipids: triglycerides, lipoproteins, cholesterol
 - 3) specific organ metabolism (brain, heart, liver, muscle)

3. Clinical Science

- a) Pituitary Disease
 - 1) hypopituitarism, pituitary removal - substitution therapy
 - (a) diabetes insipidus
 - 2) hyperpituitarism
 - (a) acromegaly - airway management
 - (b) inappropriate ADH secretion
- b) Thyroid Disease
 - 1) hyperthyroidism
 - (a) metabolic and circulatory effects
 - (b) anesthetic management
 - (c) thyroid storm
 - 2) hypothyroidism
 - (a) metabolic and circulatory effects, myxedema coma
 - (b) substitution therapy
 - (c) anesthetic implications
 - 3) complications of surgery: hypocalcemia, recurrent laryngeal nerve injury, diagnosis and treatment
- c) Parathyroid
 - 1) hyperparathyroidism; physiological effects
 - 2) hypoparathyroidism; postoperative manifestations and treatment
- d) Adrenal Disease
 - 1) Cushing's Syndrome
 - 2) primary aldosteronism
 - 3) Addison's Disease
 - 4) pheochromocytoma
 - (a) circulatory and metabolic manifestations
 - (b) diagnosis
 - (c) anesthetic management
- e) Carcinoid Syndrome

- f) Diabetes Mellitus
 - 1) pathophysiology
 - 2) control of blood glucose
 - 3) elective anesthesia - perioperative management
 - 4) emergency anesthesia - hypoglycemia; hyperglycemia and ketoacidosis
 - 5) hyperosmolar coma
 - 6) pancreas transplantation

G. HEMATOLOGY

1. Pharmacology

- a) Anticoagulants, Antithrombotics, and Anti-platelet Drugs
 - 1) mechanism of action
 - 2) comparison of drugs
 - 3) drug interactions
 - 4) monitoring of effects
 - 5) side effects and toxicity
 - 6) alternatives to transfusion: hemodilution, sequestration, autotransfusion, blood substitutes, erythropoietin
- b) Immunosuppressive and Anti-rejection Drugs

2. Clinical Science

- a) Hematologic Disorders
 - 1) diseases of blood
 - (a) anemias; compensatory mechanisms
 - (b) polycythemias; primary vs. secondary
 - (c) clotting disorders: congenital, acquired, pharmacologic (anticoagulants and antagonists)
 - (d) hemoglobinopathies, porphyrias
 - 2) transfusions
 - (a) blood preservation, storage
 - (b) blood filters and pumps
 - (c) effects of cooling and heating; blood warmers
 - (d) blood components, volume expanders
 - (e) preparation for transfusion: type and cross, type and screen, uncrossmatched blood, autologous blood, designated donors
 - (f) synthetic and recombinant hemoglobins
 - 3) reactions to transfusions
 - (a) febrile
 - (b) allergic
 - (c) hemolytic: acute and delayed
 - 4) complications of transfusions
 - (a) infections: hepatitis, human immunodeficiency virus (HIV), cytomegalovirus (CMV), others
 - (b) citrate intoxication
 - (c) electrolyte and acid base abnormalities

- (d) massive transfusion: coagulopathies, hypothermia
- (e) pulmonary; transfusion-related acute lung injury
- (f) immunosuppression

IV. CLINICAL SUBSPECIALTIES

A. PAINFUL DISEASE STATES

1. Pathophysiology

- a) Acute Postoperative and Posttraumatic Pain, ASA Practice Guidelines
- b) Cancer-Related Pain, ASA Practice Guidelines
- c) Other Chronic Pain States, ASA Practice Guidelines
 - 1) acute and chronic neck and low back pain
 - 2) neuropathic pain states
 - (a) complex regional pain syndrome, types I and II
 - (b) postherpetic neuralgia
- d) Central Pain; Phantom Limb Pain, Post-Stroke Pain
 - 1) myofascial pain
 - 2) other somatic pain conditions: arthropathy, etc.

2. Treatment

- a) Cancer Pain
 - 1) systemic medications, tolerance and addiction
 - 2) continuous spinal and epidural analgesia
 - 3) neurolytic and non-neurolytic blocks
- b) Chronic Pain (Non-Cancer-Related)
 - 1) systemic medications: nonsteroidal anti-inflammatory drugs (NSAIDs), opioid analgesics, anticonvulsants, antidepressants
 - 2) spinal and epidural analgesia
 - 3) peripheral nerve blocks
 - 4) sympathetic nerve blocks
 - 5) other techniques: TENS, spinal cord stimulation, neuroablation (surgical and chemical neurolysis)

B. PEDIATRIC ANESTHESIA

1. Apparatus: Breathing Circuits, Humidity, Thermal Control

2. Premedication: Drugs; Dosage; Routes; Vehicles, Including Eutectic Mixture of Local Anesthetics (EMLA) Cream; Parental Presence

3. Agents and Techniques

- a) Induction Techniques
- b) Anesthetics: Actions Different From Adults
- c) Neuromuscular Blockers (Sensitivity, Congenital Diseases, Complications of Succinylcholine)
- d) Regional Anesthesia

- 4. Fluid Therapy and Blood Replacement, Physiologic Anemia, Glucose Requirements**
- 5. Problems in Intubation (Full Stomach, Diaphragmatic Hernia, Tracheo-esophageal (T-E) Fistula, Pierre-Robin Syndrome, Awake/Fiberoptic Intubation, Dentition)**
- 6. Neonatal Physiology**
 - a) Respiratory
 - 1) development, anatomy, surfactant
 - 2) pulmonary oxygen toxicity
 - 3) pulmonary function
 - 4) lung volumes vs. adult
 - 5) airway differences, infant vs. adult
 - b) Cardiovascular
 - 1) transition, fetal to adult
 - 2) persistent fetal circulation
 - c) Retinopathy of Prematurity: Anesthetic Implications
 - d) Metabolism, Fluid Distribution and Renal Function
 - e) Thermal Regulation (Neutral Temperature, Nonshivering Thermogenesis)
 - f) Fetal Hemoglobin
 - g) Prematurity, Apnea of Prematurity
 - h) Bronchopulmonary Dysplasia
- 7. Congenital Heart Disease**
 - a) Cyanotic Defects
 - b) Acyanotic Defects
 - c) Primary Pulmonary Hypertension
 - d) Altered Uptake/Distribution of IV and Inhalation Anesthetics
 - e) Anesthetic Considerations
 - 1) cardiac surgery; corrective and palliative
 - 2) noncardiac surgery
- 8. Emergencies in the Newborn**
 - a) Diaphragmatic Hernia
 - b) Tracheoesophageal Fistula
 - c) Neonatal Lobar Emphysema
 - d) Pyloric Stenosis
 - e) Necrotizing Enterocolitis
 - f) Omphalocele/Gastroschisis
 - g) Respiratory Distress Syndrome (RDS): Etiology, Management, Ventilation Techniques
 - h) Myelomeningocele
- 9. Common Pediatric Medical Problems With Anesthetic Implications**
 - a) Upper Respiratory Infections
 - b) Muscular Dystrophies

- c) Developmental Delay
- d) Airway Foreign Bodies

10. Postoperative Analgesia

- a) Systemic Medications and Routes of Administration, Multimodal Therapy
- b) Regional Techniques: Caudal, Epidural, Nerve Blocks

11. Postoperative Nausea and Vomiting: Risk Factors, Prophylaxis, Treatment

C. OBSTETRICAL ANESTHESIA

1. Maternal Physiology

- a) Effects of Pregnancy on Uptake and Distribution
- b) Respiratory (Anatomy, Lung Volumes and Capacities, Oxygen Consumption, Ventilation, Blood Gases, Acid Base)
- c) Cardiovascular (Aorto-caval Compression, Regulation of Uterine Blood Flow)
- d) Renal
- e) Liver (Albumin/Globulin Ratio, Protein Binding of Drugs)
- f) Gastrointestinal (Gastric Acid, Motility, Anatomic Position, Gastroesophageal Sphincter Function)
- g) Hematology (Blood Volume, Plasma Proteins, Coagulation)
- h) Placenta
 - (1) placental exchange - O₂, CO₂
 - (2) placental blood flow
 - (3) barrier function

2. Maternal-Fetal

- a) Pharmacology
 - 1) anesthetic drugs and adjuvants
 - 2) oxytocic drugs (indications, adverse effects)
 - 3) tocolytic drugs (indications, adverse effects)
 - 4) antiseizure drugs; interactions (magnesium sulfate)
 - 5) mechanisms of placental transfer
 - 6) fetal disposition of drugs
 - 7) drug effects on newborn
- b) Amniotic Fluid (Amniocentesis, Oligohydramnios, Polyhydramnios)
- c) Antepartum Fetal Assessment and Therapy (Ultrasonography, Fetal Heart Rate Monitoring)
- d) Anesthetic Techniques and Risks (Elective vs. Emergency, General vs Regional)
 - 1) systemic medications: opioids, sedatives, inhalational agents
 - 2) regional techniques
 - (a) epidural, caudal, spinal, combined spinal/epidural

- (b) paracervical block, lumbar sympathetic block, pudendal block
- 3) complications (aspiration, nerve palsies)
- e) Physiology of Labor (Metabolism, Respiration, Thermoregulation)
- f) Influence of Anesthetic Technique on Labor
- g) Cesarean Delivery: Indications, Urgent/Emergent, Anesthetic Techniques and Complications, Difficult Airway, Aspiration Prophylaxis

3. Pathophysiology of Complicated Pregnancy

- a) Problems During Pregnancy and Delivery
 - 1) anesthesia for cerclage or non-obstetric surgery
 - 2) ectopic pregnancy
 - 3) spontaneous abortion
 - 4) gestational trophoblastic disease (hydatid mole)
 - 5) autoimmune disorders (lupus, antiphospholipid syndrome)
 - 6) endocrine (thyroid, diabetes, pheochromocytoma)
 - 7) heart disease (valvular disorders, pulmonary hypertension, congenital heart disease, arrhythmias, cardiomyopathy)
 - 8) hematologic (sickle cell anemia, idiopathic thrombocytopenic purpura, von Willebrand disease, Disseminated Intravascular Coagulation, (DIC), anticoagulant therapy, Rh and ABO incompatibility)
 - 9) hypertension (chronic, pregnancy-induced)
 - 10) neurologic (seizures, myasthenia, spinal cord injury, multiple sclerosis, subarachnoid hemorrhage)
 - 11) respiratory (asthma, respiratory failure)
 - 12) renal
 - 13) human immunovirus infection
- b) Problems of Term and Delivery
 - 1) intrapartum fetal assessment (fetal heart rate monitoring, fetal scalp blood gases, fetal pulse oximetry)
 - 2) preeclampsia and eclampsia
 - 3) supine hypotensive syndrome
 - 4) aspiration of gastric contents
 - 5) embolic disorders (amniotic fluid embolism, pulmonary thromboembolism)
 - 6) antepartum hemorrhage (placenta previa, abruptio placenta, uterine rupture)
 - 7) postpartum hemorrhage (uterine atony, placenta accreta)
 - 8) cord prolapse
 - 9) retained placenta
 - 10) dystocia, malposition, and malpresentation (breech, transverse lie)

- 11) maternal cardiopulmonary resuscitation
 - 12) fever and infection
 - 13) preterm labor
 - 14) vaginal birth after cesarean section (VBAC)
 - 15) multiple gestation
- c) Resuscitation of Newborn
- 1) Apgar scoring
 - 2) umbilical cord blood gas measurements
 - 3) techniques and pharmacology of resuscitation
 - 4) intrauterine surgery (maternal and fetal considerations, intrauterine fetal resuscitation)

D. OTOLARYNGOLOGY (ENT) ANESTHESIA: AIRWAY ENDOSCOPY; MICROLARYNGEAL SURGERY; LASER SURGERY: HAZARDS, COMPLICATIONS; JET VENTILATION

E. ANESTHESIA FOR PLASTIC SURGERY, LIPOSUCTION

F. ANESTHESIA FOR LAPAROSCOPIC SURGERY; CHOLECYSTECTOMY; GYNECOLOGIC SURGERY; GASTRIC STAPLING; HIATUS HERNIA REPAIR; ANESTHETIC MANAGEMENT; COMPLICATIONS

G. OPHTHALMOLOGIC ANESTHESIA, RETROBULBAR AND PERIBULBAR BLOCKS; OPEN EYE INJURIES

H. ORTHOPEDIC ANESTHESIA; TOURNIQUET MANAGEMENT, COMPLICATIONS, REGIONAL VS. GENERAL ANESTHESIA

I. TRAUMA, BURN MANAGEMENT, MASS CASUALTY, BIOLOGICAL/CHEMICAL WARFARE

J. AMBULATORY ANESTHESIA:

1. Patient Selection; Anesthetic Management; Discharge Criteria

2. Organization:

a. Safety requirements, (equipment, emergency plan)

b. Office-Based Anesthesia: Special considerations

K. GERIATRIC ANESTHESIA / AGING

1. Pharmacological Implications, MAC Changes

2. Physiological Implications: CNS, Circulatory, Respiratory, Renal, Hepatic

V. SPECIAL PROBLEMS OR ISSUES IN:

A. ELECTROCONVULSIVE THERAPY

B. ORGAN DONORS: PATHOPHYSIOLOGY AND CLINICAL MANAGEMENT

C. RADIOLOGIC PROCEDURES; CT SCAN; MRI: ANESTHETIC IMPLICATIONS/MANAGEMENT, ANESTHESIA IN LOCATIONS OUTSIDE THE OPERATING ROOMS

D. ETHICS, PRACTICE MANAGEMENT, AND MEDICOLEGAL ISSUES

1. Professionalism and Credentialing, Licensure
2. Ethics, Advance Directives/Do Not Resuscitate (DNR) Orders; Patient Privacy Issues, e.g., Health Insurance Portability and Accountability Act (HIPAA)
3. Malpractice: Definition, Legal Actions and Consequences, National Practitioner Database, Closed Claims Findings, Anesthetic Accidents, Professional Liability Insurance
4. Practice Management; Medicare/Medicaid Requirements
5. Primary Certification, Recertification, Maintenance of Certification and Related Issues (Professional Standing, Lifelong Learning, Cognitive Knowledge, Clinical Practice Assessment, Systems-Based Practice)
6. Costs of Medical/Anesthesia Care, Operating Room Management



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