

Guidelines for competency based postgraduate training programmes for Diploma Anaesthesiology

Preamble

A postgraduate specialist having undergone the required training should be able to recognize the health needs of the community should be competent to handle effectively medical problems and should be aware of the recent advances pertaining to his speciality. The PG student should acquire the basic skills in teaching of medical/ para medical student. He/She is also expected to know the principles of research methodology and modes of consulting library.

Programme Objectives

At the end of postgraduate training the student should be able to:-

1. Practice his specialty ethically
2. Demonstrate sufficient understanding of basic sciences related to his speciality.
3. Diagnose and manage majority of conditions in his speciality (clinically and with the help of relevant investigations)
4. Plan and advise measures for the prevention and rehabilitation of patients belonging to his speciality
5. Play the assigned role in the implementation of National Health Programs
6. Demonstrate competence in basic concepts or research methodology
7. Develop good teaching skills

Specific Learning Objectives

1. Theoretical Knowledge

Students must have fair knowledge of basic sciences (Anatomy, Physiology, Biochemistry, Microbiology, Pathology and Pharmacology) as applied to his speciality. He/She should acquire in-depth knowledge of his subject including recent advances. He should be fully conversant with the bedside procedures (diagnostic and therapeutic) and having knowledge of latest diagnostics and therapeutics available.

2. Clinical / Practical Skills

A student be expert in good history taking, physical examination, providing basic life support and advanced cardiac life support, common procedures like FNAC, Biopsy, aspiration from serous cavities, lumbar puncture etc. He/She should be able to choose the required investigations.

3. Research

He/She should know the basic concepts of research methodology, plan a research project and should know how to consult library. Basic knowledge of statistics is also required.

4. Teaching

Should learn the basic methodology of teaching and develop competence in teaching medical / paramedical students.

Postgraduate Training

Didactic lectures are of least importance; seminars, journal clubs, symposia, reviews and guest lectures should get priority for theoretical knowledge. Besides teaching, grand rounds, interactive group discussions and clinical demonstrations should be the hallmark of clinical/ practical learning. Student should have hands on training in performing various procedures (medical / surgical concerning his subject) and ability to interpret various test/ investigations. Exposure to newer specialized diagnostic / therapeutic procedures concerning his subject should be given.

Objectives

At the end of a 2-year training course a candidate should have the skill to:

1. Plan and conduct anesthesia and provide postoperative care including pain relief for elective and emergency surgical procedures related to all surgical specialities.
2. Carry out basic life support(BLS) and advance life support(ALS) and train medical and paramedical staff in BLS and ALS
3. Manage patients admitted to an intensive care unit
4. Manage patients suffering from chronic intractable pain.
5. organize the Hospital environment to manage mass casualty situation
6. Critically review and acquire relevant knowledge from the journals about the new development in the speciality.
7. Should be able to participate in anesthesia audit.

To achieve these objectives the junior resident should be rotated through various speciality operation theatres. Intensive care, Emergency Room (Casualty) Out Patient Department and Peripheral anesthesia facilities. The recommended year – wise objectives and detailed curriculum for posting are:

Year-Wise Objectives

1st Year Objectives

The first year should be taught expertise in the management of ASA I and II cases. To start with they will observe and slowly become independent in giving general anesthesia and spinal anesthesia to ASA I & II cases for minor and major surgery, under graded supervision. They should be posted to the following specialities during the first year. Gynecology, General Surgery, Orthopedic, ENT, Recovery Room, and Urology.

2nd Year Objectives

The student should be taught to give general anesthesia and regional anesthesia to ASA I, II, III & IV under supervision. They should be able to give extradural block

(EDB), Spinal Block, and Peripheral Nerve Blocks under supervision. Should learn pediatric and trauma life supports and maintain skills for basic and advanced life support.

It is advised that they may be posted in the following specialties: Obstetrics, Dental Surgery, Eye, ICU and Peripheral Theatres.

Minimum procedure/ cases observed or done as given in Appendix II should be entered in the log book.

Detailed curriculum for postings

I General Goals of All Postings

1. Learn to re-evaluate patients, prioritize problems and present cases clearly and systematically to attending consultants
2. Learn anesthetic techniques and skills to anesthetize patient in locations inside and outside the operating room.
3. Learn to operate different equipment used for anesthetist.
4. Select appropriate drugs for a case and develop a good system for arranging the drug and work tables
5. Learn failed Intubation drill and difficult airway algorithms
6. Learn topical anesthesia of the airway and technique of awake intubation
7. Learn to monitor and assess anesthetic depth, volume status and replacement of fluid and blood loss. Learn appropriate use of blood and blood products
8. Learn appropriate use of Intraoperative tests blood gas coagulation tests etc.
9. Become skilled in cannulation of central and peripheral veins, arteries
10. Become skilled in using and interpreting the following routine noninvasive and invasive monitors intraoperatively;
 - a. Electrocardiogram with ST-segment analysis
 - a. Noninvasive blood pressure
 - b. Capnograph; values and changes in values and waveform.
 - c. Pulse oximetry; values and changes in values
 - d. Neuromuscular blockade monitor
 - e. Central venous pressure; values and waveform
11. Become skilled in techniques for regional anesthesia
12. Become skilled in discontinuing anesthesia and monitoring emergence from anesthesia
13. Become skilled in perioperative pain management
14. Become skilled in use of techniques for conscious sedation and monitored anesthesia care
15. Know how to successfully resuscitate, and develop skill of Basic Life Support and Advance Cardiac Life support

16. Work with other members of the OR team, including surgeons and nurses, to optimally care for surgical patients, especially develop communication skill.

II Goals of Individual Postings

A. PAC

1. Learn to collect and synthesize preoperative data from parent, hospital and other sources and to develop a rational strategy for the perioperative care of the patient.
2. Learn a thorough and systematic approach to preoperative evaluation of patients. With and without systematic diseases, undergoing different types of operations.
3. Learn to prioritize problems and to present cases clearly and systematically to attending consultants.
4. Develop working relationships with consultants in other specialities to assist in preoperative evaluation. Learn to get a good consultation.
5. Learn to interact with preoperative patients and develop effective counseling techniques for different anesthetic techniques and perioperative procedures. Learn to assess and explain risk of procedure and take informed consent.

B. Anaesthesia outside Operating Room

1. Radiology: Special anesthetic considerations for CT, MRI especially in relation to dye allergy and embolization. Problems of patients undergoing radiotherapy.
2. Anesthesia for Electroconvulsive shock therapy (ECT)

C. Urology Service

Anesthetic considerations for urological surgery, special considerations for TURP & lithotripsy

D. Trauma & Resuscitation

All residents must achieve proficiency in:

1. BCLS, ACLS, BTLS, ATLS, Cerebral preservation
2. Triage, assessment, transport and management of masses casualties, disaster management.
3. Anesthetic consideration for trauma patients
4. Documentation and medico legal aspects

E. Post Anesthesia Care Unit (PACU)

1. To assess the patient's recovery and condition for a safe discharge or transfer.
2. Observe, recognize, and learn to treat the commonly occurring problems likely to arise in the post anesthesia care unit (PACU) especially those in relation to cardio-respiratory systems. Learn to recognize:

- i. Airway integrity and compromise.
 - ii. Arrhythmia
 - iii. Hypertension
 - iv. Hypotension
 - v. Pain Prevention and relief.
 - vi. Nausea and vomiting
 - vii. Decreased urine output
 - viii. Emergence delirium
 - ix. Delayed emergence from anaesthesia
 - x. Shivering
 - xi. Post obstructive pulmonary edema
3. Assess patient recovery and understand the parameters for transfer from the PACU to the ward, ICU, Home
 4. To score the patient's condition according to the Aldrete system

F. Intensive Care Unit

1. Understand the spectrum of critical illnesses requiring admission to ICU
2. Recognize the critically ill patient who needs intensive care.
3. Learn the principles of managing critical patients.
4. Monitor progress of patients by physiological scoring systems
5. Learn about infection control and nosocomial infections
6. Learn to insert central venous lines, arterial lines and interpret the data.
7. Manage cardiovascular instability
8. Manage respiratory failure and postoperative pulmonary complications, understand the operation of mechanical ventilators including different ventilatory modalities, non invasive ventilation, complications and modes of weaning
9. Principles & application of oxygen therapy.
10. Deliver appropriate nutritional support – enteral & parenteral
11. Learn the use of sedative/hypnotic drugs in the ICU
12. Learn ethical and legal aspects of critical care
13. Learn to communicate with relatives

H. Neuroanaesthesia

1. Know the management of Head Trauma, and its anesthetic management

I. Pain Management

1. Epidural steroid injection(all Levels)
2. Long – term epidural catheterization
3. Recognize complications associated with each blocks and know appropriate treatment of each

4. Know the cutaneous dermatomal mappings.
5. Know the different modalities of physical therapy that may relieve both acute and chronic pain.
6. Know the acute pain guidelines and WHO treatment ladder.
7. Learn the pharmacology, routes of administration and risk / benefits of drugs used for acute pain relief, patient controlled analgesia.

J. Paediatric

1. Learn the difference between adult and pediatric patient as regards anatomy, physiology and principles of pharmacology.
2. Recognize and cope with the emotional problems of parents and child and principles of premedication.
3. Understand the problems of transporting a sick pediatric patient from the ward to the operating room and back with regard to temperature maintenance, cardiovascular stability, ventilation and oxygenation.
4. Learn to estimate preoperatively blood volume, hourly fluid requirements, fluid deficit, third space loss, acceptable blood loss and apply principles of fluid and blood replacement in the perioperative period.
5. Learn to induce and maintain anesthesia by inhalation, intravenous, intramuscular, and rectal routes and monitor pediatric patients.
6. Understand the various breathing circuits, endotracheal tubes and laryngoscopes used in pediatric anesthesia.
7. Understand the benefits, risks and techniques of regional anesthesia in children.
8. Learn to recognize and treat post anesthesia complications like apnea, laryngospasm etc.
9. Understand the common problems related to common congenital syndromes presenting for surgery.
10. Understand the pediatric resuscitation: drugs, doses and defibrillation.

K. Obstetric

1. Learn the physiology of normal pregnancy, fetal and placental physiology effects of anesthesia on human uteroplacental blood flow, labor and delivery
2. Understand perinatal pharmacology and placental transfer of drugs.
3. Learn all anesthetic techniques suitable for managing normal labor pain including regional anesthesia. Recognize and treat common problems related to continuous epidural.
4. Understand the advantages of regional anesthesia for cesarean section.
5. Know the risk factors, prevention and treatment of maternal aspiration
6. Recognize high-risk factors in obstetric patients and how they effect anesthetic management.
7. Recognize difficult airway and learn failed intubation drill.

8. Learn fetal monitoring techniques, assessment of a neonatal resuscitation.

I. Regional Anesthesia

1. To learn the anatomy, physiology, and appropriate management of complications of regional anesthetic techniques.
2. To understand general principles of pharmacology of local anesthetics and various adjuvants.
3. To be familiar with the relevant anatomy for regional techniques.
4. Understand the indications for and the contraindications to regional anesthetic techniques including central neuraxial blocks, peripheral nerve blocks, and sympathetic nerve blocks.
5. Assess adequacy of regional anesthesia and learn techniques of supplementation of inadequate blocks.
6. Provide effective anxiolysis and sedation of patients by both pharmacologic and interpersonal techniques.
7. Learn to perform the following regional anesthesia techniques:
 - i. Brachial plexus block
 - ii. Sciatic nerve block
 - iii. Femoral nerve block, 3 in 1 block
 - iv. Caudal block – adult and pediatric
 - v. Ankle block
 - vi. Epidural block/ Catheter
 - vii. Subarachnoid block
 - viii. Bier block

M. Dental Anesthesia

1. Understand the principles of conscious sedation
2. Principles of anesthesia in a dental chair
3. Local Blocks for Dental Surgery

O. Ophthalmology

1. Anesthetize for intra and extra ocular surgery
2. To give Monitored Anesthesia Care.
3. To give Ophthalmic nerve blocks.

P. ENT Posting

1. To give topical anesthesia for awake intubation (nasal and oral)
2. To learn anesthetic problems related to common surgical procedure including thyroid surgery, MLS, Laser surgery etc.
3. Learn to manage complications like post tonsillectomy bleeding

Attitude Development

The student should develop attitudes that lead to:

1. Life long learning and updating

2. Sympathetic Communication with patients relatives
3. Sympathetic Communication with patients
4. Appropriate communication with colleagues to function in a group in OR/ICU
5. Become a teacher for undergraduates, technicians, nurses, and paramedical staff.
6. Ability to discuss, participate in case discussion and scientific presentations.
7. Ability to function as a leader in the operating room

Postgraduate Examination (50% marks for theory and 50% for clinical/practical)

Theory 3 Papers of 3 hours each

Paper I Basic Sciences as applied to anesthesiology: anatomy, physiology, pharmacology and biochemistry, ethics, quality assurance, medicolegal aspects

Paper II Principles and Techniques of anesthesia including regional anesthesia

Paper III Anaesthesia in relation to associated systemic diseases, Intensive care medicine, Pain Medicine and

Practical 3-4 clinical cases, instruments, clinical exercise, CPR Assessment on Mannequins and viva-voce

Course contents (Components of curriculum)

No limit can be fixed and no fixed number of topics can be prescribed as course contents. He /she is expected to know his subject in depth; however, emphasis should be on the diseases / health problems most prevalent in that area. Knowledge of recent advances and basic sciences as applicable to his/her specialty should get high priority. Competence in surgical skills commensurate with the specialty (actual hands on training) must be ensured.

1. Course content (theory)

The course should include a fund of acquired information and the strategy evolved for acquiring the information. Most useful information should be included taking into account the limits of the time available. The contents should ensure that the candidate acquires basic skills and attitudes in the subject. It should discipline the thinking habit for problem solving and discovery of new knowledge in the field.

The course content should include certain facts pertaining to basic sciences, clinical specialties and anesthesiology. It should also include

ways and means of stimulating the thought processes of the candidate and ensure that the candidate can critically acquire new information from books, journals, lecture, seminars and discussions. It should include ways and means of developing reflective thinking and problem solving by critically analyzing events during anesthesia. Interpretation of these data and logical reasoning should lead to application of facts and principles in practice.

The course content should ensure that the candidate acquires the necessary aptitude and motor skills to become a competent anesthesiologist.

1st Year Theory

1. Orientation

At the beginning of the 2 Years course each student should be given an orientation to the hospital operation theatre and subject of anesthesia.

2. Introductory lectures(to be taken by the faculty) should be aimed to familiarize the student with:

- i. Basic anaesthesia delivery equipment and monitors and important principles of physics that govern the functions of these equipments.
- ii. Intravenous anesthetic drugs and inhalation agents.
- iii. Patient evaluation, interpretation of laboratory investigation as applied to the care of the patients, planning and conduct of general anesthesia, and postoperative care
- iv. Students should be taught basic and advance cardiac life support
- v. The student should be familiarized about the principle of the sterilization and universal precautions. They should be taught when to ask for consultation when necessary.

The course content of 1st Year should cover the following:

1. Anatomy related to – Diaphragm, upper and lower airway, regional anesthesia, field block, central neuraxial blockade, block for acute pain states, intramuscular injections, arterial and venous cannulations and positioning.
2. Physics related to
 - i. Anesthesia machine – assembly of necessary items.
 - ii. Airway equipment including Laryngoscopes, airway devices.
 - iii. Breathing systems
 - iv. Monitoring in anesthesia with concepts of minimum monitoring.
 - v. Gas laws, medical gas supply system.
 - vi. Fluidics
 - vii. Electricity and diathermy
 - viii. Oxygen therapy

3. Physiology related to
 - i. Theories of anesthesia
 - ii. Respiratory, cardiovascular, hepatobiliary, renal and endocrine system, pregnancy, blood, muscle & N-M junction, ECG, regulation of temperature & metabolism, stress response, cerebral blood flow and ICP
 - iii. Central, autonomic and peripheral nervous systems.
4. Pharmacology related to
 - i. General principles, concepts of Pharmacokinetics and Pharmacodynamics.
 - ii. Drug interactions in anesthesiology
 - iii. Drugs used for premedication, induction of anesthesia, general anesthetics – intravenous and inhalational, neuromuscular block and reversal.
5. Biochemistry relevant to fluid balance & blood transfusion, perioperative fluid therapy, acid base homeostasis in health and diseases.
6. Theoretical background of the commonly used anesthetic techniques of general and regional anesthesia, general principles of pre anesthetic assessment and medication, recovery from anesthesia and post operative care, effects of positioning during anesthesia.
7. Introduction to the operation theatre, post anesthesia care rooms
8. Introduction to acute, chronic pain and pain management.
9. Documentation and medico-legal aspects of anesthesia. Concept of informed consent.
10. Resuscitation basic and advanced life support (cardiac and trauma life support), neonatal resuscitation.
11. Intensive care of critical patients with introduction to artificial ventilation, management of unconscious patients, oxygen therapy, shock-pathophysiology and management.

2nd Year Theory

Anatomy related to blocks for chronic pain, chemical neurolysis and different organ systems.

1. Physics related to
 - i. Equipment used in anesthesia – monitors, ventilators, vaporizers, fibreoptics
 - ii. Laser

- iii. Pacemaker and defibrillator
- iv. Monitoring equipment used for assessment of cardiac functions, temperature, respiratory functions, blood gas, intracranial pressure, depth of anesthesia and neuromuscular block.
- v. Sterilization of equipment
- vi. Computers in anesthesia
2. Pharmacology of drugs used in cardiovascular, respiratory, endocrine, renal diseases and CNS disorders.
3. Interpretation of blood gases and other relevant biochemical values, various function test and basics of measurement techniques, ECG.
4. Special anesthetic techniques as relevant to-
 - i. Outpatient anesthesia, hypotensive anesthesia, anesthesia in abnormal environments including rural area and calamitous situations
 - ii. Associated medical disorders in surgical patients
5. geriatric and pediatric anesthesia
6. emergency, ENT, orthopedic, ophthalmology, obstetrics, dental, radio-diagnosis and radiotherapy
7. anesthetic management of burns and plastic surgery
8. Patients with severe cardiac, respiratory, renal and hepatobiliary disorders posted for unrelated surgery.
9. Management of patients in shock, renal failure, critically ill and/or on ventilator
10. Selection, maintenance and sterilization of anesthesia and related equipment.
11. Principles of human resources and material management
12. General principles of medial audit.

Critical care proposed teaching

1. Resuscitation and Medical Emergencies
 - Cardiopulmonary – cerebral Resuscitation
 - Pediatric Resuscitation
 - Resuscitation of the Newborn
 - Resuscitation Algorithms in Acute Emergency conditions
 - Intravenous and Intra-arterial Access
 - Invasive and Noninvasive Monitoring
 - Diagnosis and Treatment of shock and Circulatory dysfunction
 - Common Beside Procedure in the Intensive Care Unit
 - Clinical Decision Units and Acute Medical Emergencies
 - Rapid Identification of Coronary Artery Insufficiency
 - Drug Abuse, Overdose, and withdrawal syndromes
 - Drowning and Near Drowning
 - Injuries by Venomous and poisonous Animals
 - Anaphylactic Reactions
 - Haemodynamic Evaluation and Management of Acute Illnesses.

2. Trauma

- Physiologic Response to Injury
- Acute pain in the Intensive Care Unit
- The Coagulopathy of Trauma
- Transfusion Therapy
- Plasma and Blood Substitutes
- Management of Traumatic Brain Injury in the Intensive care unit
- Modern Management of Acute spinal cord injury
- Penetrating Injuries of the Neck
- Thoracic Injuries
- Abdominal Trauma
- Intensive Care Management of the injured child
- Burn care and inhalation injury
- Trauma to the Pregnant Patient
- Trauma care of the Elderly

3. Infectious disease

- Infections in the Surgical Critical Care Unit
- Antimicrobial Therapy in the Critical Care Setting
- Catheter Colonization and Catheter Related Bacteraemia
- Central Nervous System Infections
- Pneumonia in the Immunosuppressed Patient
- Infections in Patients with Neoplastic Disease
- Management of HIV and AIDS-Related Infection in the Intensive Care Unit
- Bacterial Pneumonia in Adult Respiratory Distress Syndrome
- Intra-abdominal Sepsis
- Laboratory Diagnosis of Infection
- Malaria and other Tropical Infections in the Intensive Care Unit
- Antimicrobial Resistance and other Epidemiologic
- Considerations in the Intensive Care Unit

4. Endocrinology, Metabolism, Nutrition, Pharmacology

a) Endocrinology:

- Thyroid Emergencies
- Diabetic Emergencies
- Adrenal Insufficiency
- Endocrine Emergencies

b) Metabolism:

- Acid-Base Balance
- Diagnosis and Treatment of Acid-Base Disorders

- Sodium and Potassium Disorders
- Calcium, Magnesium, and Phosphorus Disorders

c) Nutrition:

- Enteral Nutrition
- Total Parenteral Nutrition for the Critically ill patient
- Pediatric Enteral and Parenteral Surgical Nutrition
- Micronutrient Deficiencies
- Nutrition for the critically ill Geriatric Patient
- Obesity in the Critically ill patient

d) Pharmacology

- Sedatives and Analgesics in Critical Care
- Neuromuscular Blocking Drugs in Patients in the Intensive Care Unit
- Basic Pharmacologic Principles and Drug Monitoring
- Alterations in Drug Disposition in the Elderly

5. Cardiovascular Problems

- Applied Cardiovascular Physiology in the Critically Ill
- The Coronary Arteries in Unstable Angina pectoris, Acute Myocardial Infarction, and Sudden Coronary Death
- Treatment of Myocardial Infarction
- Contemporary Thrombolytic Therapy in Acute Myocardial Infarction
- Congestive Heart Failure in Infants and Children
- Conduction Disturbances and Cardiac Arrhythmias in the Critically ill
- Cardiac Pacemakers and Implantable Defibrillators in the Intensive Care Unit Setting
- Use of Mechanical Circulatory Support Systems in Critically Ill Patients
- Hypertensive Crises: Emergencies and Urgencies
- Hypertensive Emergencies in Infants and Children
- Treatment of Massive Pulmonary Embolism
- Severe Heart Failure in Cardiomyopathy: Pathogenesis and Treatment
- Inotropic Therapy and the Critically Ill Patient
- Air Embolization

6. Pulmonary Problems:

Part -1

- Basic Applications in Pulmonary Critical Care Medicine
- Mechanics of the Respiratory System

- Principles of Gas Exchange
- Assessment of Pulmonary Function in Critically ill patients
- Conventional Airway Access
- Patient-Ventilator Interactions
- Controlled Mechanical Ventilation
- Partial Ventilatory Assist
- Continuous Gas Flow and High Frequency Ventilation
- Noninvasive Ventilation
- Oxygenation Strategy
- Adjunctive Respiratory Therapy

Part –2 -Specific Pulmonary Problems

a) Acute Hypoxemic Respiratory Failure

- Pathophysiology of Acute Lung Injury
- Pathophysiology and Management of Acute Respiratory Distress Syndrome After Surgery, Trauma, and other Acute Illness
- Initial Management of Acute Hypoxemia
- Pulmonary Aspiration
- Weaning from Ventilatory Support in Hypoxemic Respiratory Failure

b) Acute Ventilatory Failure

- Life Threatening Asthma
- Acute Respiratory Failure in Patients with Chronic Obstructive Pulmonary Disease
- Weaning from Respiratory Support in Airflow Obstruction states

c) Other Pulmonary Diseases

- Pulmonary Embolism and Deep Venous Thrombosis
- Pulmonary Hypertension
- Severe Community Acquired Pneumonia
- Nosocomial Pneumonia

7. Abdominal Organ Failure

- The Acute Abdomen
- Severe Gastrointestinal Hemorrhage
- Acute Hepatic Failure
- Acute Pancreatitis
- Role of the gut in Multiple Organ Failure

8. Nephrology

- Clinical Assessment of Renal Function
- Prevention of Acute Renal Failure
- Adult Acute and Chronic Renal Failure

- Renal Replacement Therapy in the Intensive Care Unit
- Drug-Kidney Interactions
- Acute Renal Failure in Infants and Children

9. Central Nervous System

- Neuropathophysiology
- Postoperative Confusion
- Evaluation of Coma
- Seizures in Critically Ill Patients
- Pediatric Neurosurgical Emergencies
- Intracranial Haemorrhage
- Management of Acute Ischemic Stroke
- Neuromuscular Disorders in Critical Care

List of drugs for PG Students of MD and DA Anaesthesiology

Drug chemistry:

Solubility, partition coefficients and movement of drugs through membranes: Lipid solubility; influence of pKa and pH; partition coefficients. Passive and active transport mechanisms

Mechanisms of drug action:

Physicochemical; pharmacodynamic; pharmacokinetic: drug-receptor interactions; dose-response and log [dose]-response curves; agonists, partial agonists, antagonists. Reversible and irreversible antagonism. Potency and efficacy

Pharmacokinetics:

General principles: absorption, distribution and redistribution; elimination, excretion. Chemical properties of drugs and their pharmacokinetics: blood-brain-barrier and placental barrier. Protein binding: plasma and tissue. Body compartments; adipose and vessel-poor tissue. Bioavailability; clearance

Administration and absorption:

Routes of administration; first-pass metabolism and bioavailability. Selection of appropriate route. Drug delivery systems: e.g. sustained release, enteric coated, transdermal patch and iontophoretic systems

Oral administration:

Time-course for systemic appearance; factors e.g. pKa, lipid solubility, active transport. Bioavailability of drugs given orally and its measurement

Drug elimination from plasma:

Mechanisms: distribution; metabolism; excretion: exhalation; renal; biliary; sweat; breast milk. Factors affecting e.g.: pathological state: renal and hepatic failure; age, including extremes of age; gender; drug interactions. Active and inactive metabolites; pro-drugs. Enzyme induction and inhibition

Non-enzymatic drug elimination: Hofmann degradation

Pharmacokinetic modelling:

Types of models available: one, two and three-compartment models; non-compartmental; physiological. Pharmacokinetic parameters: volume of distribution, half-life and time constant, clearance

Context-sensitive half-time:

Comparison of drugs e.g. Propofol, Fentanyl and Remifentanyl. Target-controlled infusions [TCI]

TCI in practice:

Accuracy, applicability, cost. Variations due to patient differences: predictable and unpredictable

Differences in patient response to therapy: gender; pathology; polypharmacy; in particular, changes occurring with increasing age

Pharmacogenetics:

Pharmacokinetic variation e.g. pseudocholinesterase; acetylation; CYP450 variants. Poor and fast metabolizers; racial and geographic distribution of common abnormal genes

Volatile and gaseous anaesthetic agents:

Structure of available agents. MAC. Clinical effects: CNS [including ICP], CVS, RS. Unwanted effects of individual agents. MH susceptibility; hepatitis risks. Factors affecting onset and offset time. Oil/gas partition coefficient

Intravenous anaesthetic agents:

Chemical classes. Properties of an ideal induction agent. Adverse effects on CNS [including effects on ICP], CVS, RS; pharmacokinetics including metabolism

Mechanisms of general anaesthetic action

Benzodiazepines:

classification of action. Clinical actions. Synergism with anaesthetic agents. Antidote in overdose

Local anaesthetic agents:

Additional effects, including anti-arrhythmic effects. Mechanism of action. Clinical factors influencing choice: operative site, patient, available agents. Toxicity syndrome; safe clinical and maximum clinical doses; treatment of overdose

Analgesics:

Simple analgesics, NSAIDs and opioids. Available routes of administration; peri-operative prescribing; chronic compared with acute pain prescribing

Aspirin and paracetamol:

Comparison of structures; indications and contraindications; mechanisms of action. Bioavailability; metabolism; toxicity

Non-steroidal anti-inflammatory analgesics:

Classification. Mechanism of action. Clinical effects and uses; unwanted effects, contraindications

Opioid analgesics:

Receptor classification. Mechanism of action. Inhibitory effects, sites of action on pain pathways. Unwanted effects. Full and partial agonists and partial agonists. Routes of administration

Muscle relaxants:

Classification. Sites of action. Properties of an ideal muscle relaxant. Dantrolene and management of MH

Depolarizing muscle relaxants:

Structure, mechanism of action. Organophosphate poisoning. Adverse effects and contraindications

Non-depolarizing muscle relaxants:

Structural classification; sub-classification according to onset-time and duration of action. General comparison of aminosteroids and bisbenzyisoquinoliniums. Comparison of individual agents; metabolism and active metabolites. Unwanted effects

Reversal of neuromuscular blockade:

Indications for use; mechanisms of action; clinically unwanted effects of reversal of neuromuscular blockade

Drugs and the autonomic nervous system:

Anatomy; myelinated and unmyelinated nerves; ganglia and rami communicantes. Neurotransmitters. Sites at which drugs can interfere with autonomic transmission

Drugs and the sympathetic nervous system:

Adrenergic receptors and molecular mechanisms of action: Indications for pharmacological use of naturally occurring catecholamines and synthetic analogues. Other classes of drugs active in the sympathetic system: e.g. MAOIs:

Drugs and the parasympathetic nervous system:

Nicotinic and muscarinic receptors with subgroups. Mechanism of action. Agonists, antagonists. Comparison of available drugs. Hyoscine and antiemesis

Cardiovascular system:

General: drug effects on the heart [inotropy and chronotropy] and on the circulation: arterial and venous effects; systemic and pulmonary effects

Inotropes and pressors:

Classification; site of action. Synthetic inotropes compared with adrenaline

Drugs used in ischaemic heart disease:

Classification of drugs used. Mechanisms of drug action. Unstable angina

Antiarrhythmics:

Classification. Indications for use, including use in resuscitation

Hypotensive agents:

Classes of drugs to produce acute hypotension in theatre. Therapeutic antihypertensive agents: classification according to mechanism of action. Adverse effects of drugs in each class

Anticoagulants:

Oral and parenteral. Sites of action; indications use; monitoring effect. Comparison of heparins: unfractionated and fractionated. Newer anticoagulants

Antiplatelet agents:

Perioperative management of antiplatelet medication

Pro-coagulants:

Drugs. Individual factor concentrates; multi-factor preparations including FFP; vitamin K

Colloids, including blood and blood products:

Composition of preparations; safe use and avoidance of errors

Crystalloid fluids:

Composition; suitable fluids for maintenance and replacement of losses.
Comparison with colloids; unwanted effects

Respiratory system:

General: Classes of drugs acting on the respiratory tract including bronchodilators; oxygen; surfactant; mucolytics; pulmonary vasodilators. Methods of administration; indications for use; mechanisms of action; adverse effects, drugs used in acute severe asthma and chronic asthma; volatile agents. Mechanisms of action

Gastrointestinal system:

General: antisialogogues; drugs reducing gastric acidity; drug effects on the GI tract including gastric and bowel motility

Antiemetics:

Anatomical sites for antiemetic action; central and peripheral inputs to vomiting centre; use of dexamethasone

Renal system:

diuretics: Classification of diuretics. Unwanted effects; indications for use

CNS:

Antiepileptic agents: Mechanisms of action; unwanted side effects
Antidepressants: Classes of drug: anaesthetic relevance

Therapy for diabetes mellitus:

Drugs used in type 1 and type 2 diabetes: Insulins: classification of types available; routes of administration; perioperative management. Unwanted effects and risks and therapy of hypo- or hyperglycaemia

Hormones:

Corticosteroids: Indications for use; clinical effects; long-term complications of glucocorticoid use
Treatment of thyroid disorders: Synthesis and release of thyroid hormones. Preparations used in hyper- and hypo-thyroidism

CNS stimulants;

Classes, mechanisms of action, uses in anaesthesia
RS stimulants including theophyllines, doxapram

Antimicrobial agents:

general classification: Types of antimicrobial agents: antiviral; antibacterial; antifungal; bacteriostatic and bacteriocidal. Mechanism of action. Indications for use of different classes of antibiotics. Bacterial resistance

Effects of drugs on the eye and vision:

Includes intra-ocular pressure

Social drugs including

Tobacco, alcohol and non-legal drugs: anaesthetic relevance

Applied clinical pharmacology

Analgesia:

principles of analgesia including infusions, patient controlled analgesia; medications for chronic pain including antidepressants, anticonvulsants, antiarrhythmics; routes of administration including oral; sublingual; subcutaneous, IM; IV; inhalational analgesia, patient controlled analgesia, epidural; agents used for regional techniques and local blocks

Management of acute poisoning:

including aspirin; paracetamol; opioids; aminophylline; digoxin; ecstasy and other social drugs; antidepressants; alcohol

Drug toxicity, causes and avoidance.**Management of malignant hyperthermia.****Potential risks of drug additive****Pharmacokinetics.**

Including target controlled infusions and effects of renal and/or hepatic impairment on drug disposition and elimination of; influence of renal replacement therapies of commonly used drugs

Cardiovascular System:

Principles and use of inotropes and vasodilators, including pulmonary vasodilators; pharmacological problems in cardiopulmonary bypass, cardioplegia; Management of arrhythmias

Use of drugs in the management of cardiogenic shock and cardiac failure

Management of hypertension before anaesthesia, including acute management and pheochromocytoma. Manipulation of blood pressure to assist surgery

Antibiotics:

principles of action; choice of drug. Antibiotic prophylaxis against surgical infection including subacute bacterial endocarditis. Therapy of bacterial, fungal and viral infections

**Anticoagulant and thrombolytic prophylaxis and therapy,
including management of pulmonary embolus**

The Respiratory System:

Management of severe asthma; use of gases: helium and nitric oxide

The Gastrointestinal System:

Acid aspiration prophylaxis; anti-emetics

CNS:

General vs regional anaesthesia in all areas of anaesthesia; action of drugs on the eye; control of convulsions

The Musculoskeletal System:

Muscle relaxants and reversal agents; anaesthetic implications of myasthenia gravis and other neuromuscular disorders

Resuscitation:

Including management of allergy and anaphylaxis

Principles of parenteral and enteral nutritional formulas in intensive care**Therapeutics in pathologic states:**

Problems associated with organ transplantation

Anaesthetic relevance of drugs used in malignancy; therapy in acute and chronic respiratory diseases

Problems of drug dependency and addiction**Environmental effects of anaesthetic agents****Influence of age on drug pharmacokinetics and pharmacodynamics**

Assessment of cognitive dysfunction issues such as delirium, POCD and dementia, and implications

TIVA and TCI:

Demonstrate how a TCI system is set-up and used to deliver both induction and maintenance levels of intravenous agents. Discuss the advantages and disadvantages of such a technique

Adverse event reporting:

Discuss investigation of a suspected allergic responses to drugs administered during anaesthesia

List of Instruments for PG Students of MD and DA Anaesthesiology

Medical Gas Cylinders and Containers

1. Definitions

Psi, Psig, Psia, Nonliquefied Compressed Gas, Liquefied Compressed Gas

2. Regulatory Agencies and Industry Standards

3. Medical Gas Cylinders

Components, Sizes, Contents and Pressure, Testing, Filling
Colour, Markings, Labelling, Tags
Rules for Safe Use of Cylinders, Transfilling, Hazards

Medical Gas Pipeline Systems

1. Components

Supply Sources, Piped Distribution System, Pressure Relief Valves
Shutoff Valves, Emergency Oxygen Supply Connector
Alarms, Pressure Gauges, Terminal Units, Hoses

2. Testing Medical Gas Distribution Systems

Installer-performed Tests, System Verification, Periodic Testing and Preventive Maintenance

3. Problems

Inadequate Pressure, Leaks, Excessive Pressure, Alarm Problems, Cross Connection of Gases, Gas Contamination, Fires, Depleted Reserve Supply

Suction Equipment

General Principles, Equipment, Portable Suction Units, Closed Suction Catheter System
Continuous Irrigation Suction Catheter, Suctioning Techniques, Hazards Associated with Suctioning

Oxygen Concentrators

Introduction, Technology, Concentrator Design, Operation, Applications
Advantages, Disadvantages, Hazards

The Anaesthesia Machine

1. Electrical system

Master Switch, Power Failure Indicator, Reserve Power, Electrical Outlets, Circuit Breakers

2. Pneumatic System

The High-pressure System, Intermediate Pressure System, Low-pressure System

3. Choosing an Anaesthesia Machine Servicing

4. Choice of anaesthesia machine**5. Vaporizers**

Vapour Pressure, Boiling Point, Gas Concentration, Heat of Vaporization, Specific Heat
Thermal Conductivity, Thermal stabilisation

6. Vaporizer Design

Concentration Calibration, Vaporization Methods, Temperature Compensation

7. Effects of Altered Barometric Pressure**8. Effects of Intermittent Back Pressure**

Pumping Effect, Pressurizing Effect, Interplay between Pressurizing and Pumping Effects

9. Vaporizers and Standards

Concentration-calibrated Vaporizers

10. Agent specific filling systems

Components, use, problems with agent specific filling devices

11. Location

Concentration calibrated vaporisers in system vaporisers

12. Vaporiser mounting systems

Permanent, Detachable

13. Interlock devices**14. Hazards of vaporisers****15. Preventive maintenance****The Breathing System: General Principles, Common Components, and Classifications****1. General Principles**

Resistance, Rebreathing, Discrepancy between Inspired and Delivered Volumes
Discrepancy between Inspired and Delivered Oxygen and Anaesthetic Gas
Concentrations

2. Common Components

Bushings, Sleeves, Connectors and adaptors, Reservoir bag, Breathing tubes
Adjustable pressure limiting valve, PEEP Valves, Filters, Equipment to administer bronchodilators

3. Size and type of fittings - Classification of breathing systems

Classification by function, Classification by equipment

4. Mapleson Breathing Systems

Types, Configurations, Techniques of Use, Functional Analysis, Hazards, Tests
Respiratory Gas Monitoring with the Mapleson Systems, Advantages of the Mapleson Systems, Disadvantages of the Mapleson Systems

5. The Circle System

CO₂ Absorber, Absorbents, Unidirectional Valves, Inspiratory and Expiratory Ports
Y-piece, Fresh Gas Inlet, Adjustable Pressure-limiting Valve, Pressure Gauge
Breathing Tubes, Reservoir Bag, Bag/Ventilator Selector Switch
Respiratory Gas Monitor Sensor or Connector, Airway Pressure Monitor Sensor
Optional Equipment

Arrangement of Components

Objectives, Consideration of Individual Components, Gas Flows through the Breathing System

Classic, Anestar, ADU, Drager6400, FabiusGS, Apollo

Resistance and Work of Breathing in the Circle System, Dead Space of the Circle System

Heat and Humidity, Relationship between Inspired and Delivered Concentrations

6. Circle System with Low Fresh Gas Flows

Definitions, Equipment, Techniques, Advantages, Disadvantages

Manual Resuscitators

1. Introduction

2. Components

Self-expanding Bag, Nonbreathing Valve, Bag Inlet Valve, Pressure-limiting Device
Oxygen-enrichment Device, Positive End-expiratory Pressure Device, Scavenging Mechanism

3. Functional Analysis

Respiratory Volumes, Delivered Oxygen Concentration, Rebreathing

4. Uses

5. Hazards

High Airway Pressure, Rebreathing, Hypoventilation, Low Delivered Oxygen Concentrations
High Resistance, Contamination, Inhalation of Foreign Bodies

6. Advantages

7. Disadvantages

Humidification Equipment - Terminology Inter-relationships

1. Considerations for Anaesthesia

Effects of Inhaling Dry Gases

2. Sources of Humidity

Carbon Dioxide Absorbent, Exhaled Gases, Moistening the Breathing Tubes and Reservoir Bag, Low Fresh Gas Flows, Heat and Moisture Exchangers
Heated breathing tubes, Humidifiers, Nebuliser

Anaesthesia Ventilators

1. Relationship of the Ventilator to the Breathing System

2. Components

Driving Gas Supply, Controls, Alarms, Pressure-limiting Mechanism
Bellows Assembly, Exhaust Valve, Spill Valve, Ventilator Hose Connection

3. Ventilation Modes

Volume Control, Pressure Control, Intermittent Mandatory
Synchronized Intermittent Mandatory ventilation, Mandatory Minute, Pressure Support

4. Specific Ventilators

Drager Evita 2 dura, Drager Divan, Drager Fabius GS, Drager Apollo

5. General Hazards

Hypoventilation, Hyperventilation, Hyperoxia, Excessive Airway Pressure
Negative Pressure during Expiration, Alarm Failure

6. Advantages and Disadvantages

Scavenging system

Mechanism, Techniques, Hazards, Monitoring

Hazards of Anaesthesia Machines and Breathing Systems

1. Hypoxia

Hypoxic Inspired Gas Mixture, Hypoventilation

2. Hypercapnia

Hypoventilation, Inadvertent Carbon Dioxide Administration
Rebreathing without Carbon Dioxide Removal

3. Hyperventilation**4. Excessive Airway Pressure**

Modifying Factors, Causes, Detection, Response

5. Inhalation of Foreign Substances

Absorbent Dust, Medical Gases Contaminants, Parts of Breathing System Components
Other Foreign Bodies

6. Anaesthetic Agent Overdose

Tipped Vaporizer, Vaporizer or Nitrous Oxide Inadvertently Turned ON, Incorrect Agent
Improper Vaporizer Installation, Overfilled Vaporizer, Vaporizer Interlock System
Failure

7. Inadequate Anaesthetic Agent Delivery

Decreased Nitrous Oxide Flow, Unexpectedly High Oxygen Concentration
Air Entrainment, Faulty Vaporizer, Empty Vaporizer, Incorrect Agent in Vaporizer
Incorrect Vaporizer Setting, Anaesthetic Agent Breakdown

8. Inadvertent Exposure to Volatile Agents**9. Fires and explosion****10. Physical damage****11. Latex allergy**

Sources, Individuals at risk, Clinical picture, Prevention

Face Masks

Description, Specific Masks, Techniques of Use, Difficult Face Mask Ventilation
Dead Space, Mask Straps, Advantages, Disadvantages, Complications

Airways

Purpose, Types, Description, Complications

Laryngeal Mask Airway Family**1. Types**

LMA-Classic, LMA-Flexible, LMA-Fastrach

2. Use

Inspection before use, Preparation of mask, Insertion, Fixation
Maintenance, Emergence, Tracheal intubation, Insertion of nasogastric tube

3. Care of laryngeal mask

4. Physical consideration

5. Useful situations

6. Complications

7. Advantages and Disadvantages

Laryngoscopes

1. Rigid Laryngoscopes

Description, Techniques of use, Cleaning

2. Flexing fiberoptic endoscope

Description, Techniques of use, Advantages, Disadvantages, Cleaning

3. Lighted intubation stylet

Description, Techniques of use, Advantages, Disadvantages, Cleaning, Hazards

4. The Bullard laryngoscope

Description, Techniques of use, Advantages, Disadvantages

5. Wuscope

Description, Techniques of use, Advantages, Disadvantages

6. Flexguide intubating fiberscope

7. Tooth protector

8. Complications of laryngoscopy

Tracheal tubes

1. General principles

Resistance and work of breathing, Dead space

2. Tracheal tubes

Materials of construction, Tube design, Special tubes, Tube size, Tube length

Tube markings, Cuff systems, Device to measure cuff pressure, Devices to limit cuff pressure, Tracheal tube connectors, Laser resistant wraps for tracheal tubes

3. Use of tracheal tube

Choosing the tube, Checking the tube, Preparing tube, Inserting tube
Checking position, Inflating the cuff, Securing the tube, Changing the tube

4. Perioperative complications

5. Double lumen tubes

Indications, Contraindications, Anatomical consideration, Design
Margin of safety in positioning DLT, Specific tubes, Techniques, Hazards with DLT

6. Coaxial system for one lung ventilation -Single lumen bronchial tubes

Indications, Devices, Techniques of use, Disadvantages

7. Stylets and bougies

8. Forceps

Monitoring devices

Gas Monitoring

1. Definitions

Monitor Types

2. Technology

Mass spectrometry, Raman light scattering gas analysis, Infrared analysis
Electrochemical analysis, Paramagnetic analysis, Piezoelectric analysis
Chemical carbon dioxide detection

3. Gases

Oxygen, CO₂ analysis, Volatile anaesthetic agents, Nitrous oxide, Nitrogen

4. Airway pressures, volumes and flows

Equipment

5. Pulse oximetry

Introduction, Principles of operation, Physiology, Equipment, Oximeter standards
Use, Testing, Applications, Advantages, Limitations, Disadvantages, Patient complication

6. Neuromuscular transmission monitoring

Equipment, Methods for Evaluating Evoked Responses, Choice of Monitoring Site

Use, Hazards

7. Temperature monitoring

Indications, Technology, Sites, Use, Hazards of thermometry