Primary FRCA Syllabus

Candidates should be able to demonstrate a good understanding of the fundamentals of clinical anaesthetic practice, with an ability to discern when more senior assistance will be required.

Anaesthetic equipment and safety

Physical principles underlying the function of the anaesthetic machine, pressure regulators, flowmeters, vaporizers, breathing systems. Absorption of carbon dioxide
Principles of lung ventilators, disconnection monitors
Manufacture and storage of oxygen, nitrous oxide, carbon dioxide, compressed air.
Pipeline and suction systems, gas cylinders
Humidification devices
Minimum monitoring requirements
Environmental control of the operating theatre including scavenging systems for waste anaesthetic gases and vapours
Pre-use checks of anaesthetic machine, breathing systems and monitoring apparatus
Anaesthetic records and critical incidents
Function and use of related anaesthetic and resuscitation equipment including that used for regional anaesthesia. Airways, tracheal tubes, tracheostomy tubes, laryngeal masks, oxygen therapy equipment, self-inflating bags, spinal and epidural needles, intravenous cannulae and transfusion devices
Sterilisation and cleaning of equipment

Preoperative assessment

Implications for anaesthesia of commoner medical conditions. In particular, respiratory
diseases (e.g. asthma, chronic obstructive airway disease), cardiac disease (e.g. angina pectoris, valvular disease, myocardial infarction, pacemakers, arrhythmias), vascular disease (e.g. hypertension), sickle cell disease and anaemias, rheumatoid arthritis, renal dysfunction and insufficiency, plasma electrolyte disturbance (e.g. hyper- and hypokalemia), diabetes mellitus, liver disease
Implications for anaesthesia of commoner surgical conditions, trauma, intestinal obstruction and acute abdominal emergencies
ASA classification and other pre-anaesthetic scoring systems such as Glasgow coma scale
Interpretation of relevant preoperative investigations, plasma electrolytes, haematology, disturbances of acid/base status, ECG, X-rays, pulmonary function tests and clotting abnormalities
Preoperative assessment of a patient of any age (excluding neonates) for elective or emergency surgery
Restriction of food and fluid by mouth, cessation of smoking, correction of dehydration
Assessment of difficulty of tracheal intubation
Precautions in the management of the infective patient (e.g. hepatitis B positive or HIV positive)
Anaesthetic implications of current drug therapy such as beta blockers, antihypertensive drugs, tricyclic antidepressant agents and monoamine-oxidase inhibitors, insulin, anti-diabetic drugs, anticoagulants, contraceptives
**Assessment of post-operative analgesic needs**

**Premedication**

Rationale for premedicant drugs. Choice of drugs, advantages and disadvantages

**Induction**

Intravenous and inhalational induction of anaesthesia; advantages and disadvantages, techniques
Recognition and management of anaphylactic and anaphylactoid reactions including follow up and patient information
Indications for tracheal intubation.
Management of difficult intubation and failed intubation
Recognition of correct placement of tracheal tube, oesophageal and endobronchial intubation, complications
Causes of regurgitation and vomiting during induction, prevention and management
Technique of cricoid pressure. Pulmonary aspiration
Induction of anaesthesia in special circumstances, head injury, full stomach, upper airway obstruction

**Intraoperative**

Ability to deal with emergencies before, during and after anaesthesia and the ability to stabilise a patient's condition until senior assistance can be obtained.
Techniques of maintenance of anaesthesia. To provide adequate analgesia using opioids and other analgesic drugs. To prevent awareness. Management of appropriate intermittent positive pressure ventilation. Airway control. Intraoperative fluid therapy. Minimal monitoring
Diagnosis and management of important critical incidents during anaesthesia including: cyanosis, hypertension, hypotension, cardiac arrhythmias, bronchospasm, respiratory obstruction, increased peak inspiratory pressure, hyper- and hypocarbia, failed intubation, failed reversal
Management of massive haemorrhage, volume expansion, blood transfusion (hazards including incompatibility reaction), gas embolism, malignant hyperthermia
Correct intraoperative positioning on theatre table - complications, prone position
Diagnosis and treatment of pneumothorax

**Postoperative**

Causes and treatment of failure to breathe at end of operation, suxamethonium apnoea- management
Care of the unconscious patient
Recovery room diagnosis and treatment of inadequate pulmonary ventilation, cyanosis, hypo- and hypertension, shivering, stridor. Oxygen therapy, indications and techniques
Methods of pain management. Assessment of pain and analgesic techniques
Prevention, diagnosis and treatment of postoperative pulmonary atelectasis, deep vein thrombosis and pulmonary embolus
Postoperative fluid therapy
Causes and treatment of postoperative nausea and vomiting
Minor and major adverse sequelae to anaesthesia and their management
Anaesthesia in special circumstances

Principles of obstetric anaesthesia
Principles of the care of children (excluding neonates and infants) undergoing anaesthesia for straightforward surgical procedures, including ENT, eye and dental operations
Principles of general anaesthesia for simple ophthalmic procedures and a penetrating eye injury
Patients with a pacemaker
Advantages and problems associated with day surgery, appropriate anaesthetic techniques
Principles of neurosurgical anaesthesia as applied to the management of the head-injured patient
Problems of anaesthesia in the obese patient
Repeat anaesthesia - hepatic injury
Implications for the anaesthetist of viral hepatitis and HIV infections
Laparoscopic and minimally invasive procedures
Management of patients requiring transfer

Regional anaesthesia

Indications, technique and management of the complications of spinal and epidural (including caudal approach) analgesia. Techniques including intravenous regional anaesthesia, brachial plexus block, femoral nerve block, inguinal field block, ankle block and dorsal nerve of the penis block
Local anaesthesia for awake tracheal intubation

Resuscitation

Immediate care and resuscitation in patients of all ages. The guidelines promulgated by the European Resuscitation Council and the Resuscitation Council [UK] will be followed. The syllabus will include:

Patient assessment

The principles and practice of life support
The principles and practice of recognition and management of life-threatening arrhythmias including defibrillation and drug therapy
The techniques of venous access and the intraosseous route
Management of the airway and ventilation in the emergency including care of cervical spine
Specific problems in paediatric resuscitation
Ethical aspects of resuscitation

Trauma

Pathophysiology of trauma and hypovolaemia
Assessment, immediate care and management of trauma patients of all ages
Performance and interpretation of the primary and secondary survey
Immediate specific treatment of life-threatening illness or injury, with special reference to thoracic and abdominal trauma
Care of cervical spine injury
Emergency airway management and oxygen therapy
Cannulation of major vessels for resuscitation and monitoring
Management of hypovolaemic shock
Chest drain insertion and management
Pain management in trauma victims
Candidates should be able to demonstrate a good understanding of human anatomy relevant to the practice of anaesthesia.

**Respiratory System**

Mouth, nose, pharynx, larynx, trachea, main bronchi, segmental bronchi, structure of bronchial tree
Pleura, mediastinum
Lungs, lobes, bronchopulmonary segments. Structure of lungs
Innervation of respiratory tract, blood supply and lymphatic drainage
Diaphragm, muscles of respiration, innervation
Cardiovascular system
Heart, chambers, conducting system, blood and nerve supply. Pericardium
Great vessels, main peripheral arteries and veins
Fetal circulation

**Nervous system**

Brain and spinal cord, structure of spinal cord, age variation, spinal meninges, subdural and extradural space, contents of extradural space, CSF
Spinal nerves, dermatomes
Cervical plexus, brachial plexus, nerves of arm
Intercostal nerves
Lumbar plexus, nerves of abdominal wall
Sacral and coccygeal plexuses, nerves of leg
Autonomic nervous system, sympathetic innervation, sympathetic chain, ganglia and plexuses
Stellate ganglion
Parasympathetic innervation. Coeliac plexus
Cranial nerves. Trigeminal ganglion
Vertebral column
Cervical, thoracic and lumbar vertebrae
Sacrum, sacral hiatus
Ligaments of vertebral column

**Areas of special interest**

Base of skull
The thoracic inlet and 1st rib
Intercostal spaces including paravertebral space
Abdominal wall (including the inguinal region)
Antecubital fossa
Large veins of neck
Large veins of leg
Diaphragm
Anatomy of tracheostomy, cricothyrotomy
Eye and orbit
Axilla
Candidates should have a good general understanding of human physiology, and recognise the need to apply physiological principles and knowledge to the clinical practice of anaesthesia.

**General**

- Organisation of the human body and control of internal environment
- Differences between neonates, infants, children, adults and the elderly
- Function of cells; genes and their expression
- Cell membrane characteristics; receptors
- Protective mechanisms of the body

**Biochemistry**

- Acid base balance and buffers
- Ions e.g. Na+, K+, Ca++, Cl-, HCO3-
- Body fluids and their functions and constituents
- Capillary dynamics and interstitial fluid
- Osmolarity: osmolality, partition of fluids across membranes

**Lymphatic system**

- Special fluids especially cerebrospinal fluid and ocular fluids. Also pleural, pericardial and peritoneal fluids
- Haematology and Immunology
- Red blood cells: haemoglobin and its variants. Blood groups
- Haemostasis and coagulation
- White blood cells
- The inflammatory response
- Immunity and allergy

**Muscle**

- Action potential generation and its transmission
- Neuromuscular junction and transmission
- Muscle types
- Skeletal muscle contraction
- Smooth muscle contraction
- Motor unit

**Heart/Circulation**

- Cardiac muscle contraction
- The cardiac cycle: pressure and volume relationships
- Regulation of cardiac function; general and cellular
- Control of cardiac output
- Rhythmicity of the heart
- Electrocardiogram and arrhythmias
- Neurological and humoral control of systemic blood pressures, blood volume and blood flow (at rest and during physiological disturbances e.g. exercise, haemorrhage and Valsalva manoeuvre)
Peripheral circulation: capillaries, vascular endothelium and arteriolar smooth muscle, tissue
Characteristics of special circulations including: pulmonary, coronary, cerebral, renal, portal and fetal

**Renal tract**

Blood flow and glomerular filtration and plasma clearance
Tubular function and urine formation
Regulation of fluid and electrolyte balance
Regulation of acid-base balance
Micturition

**Respiration**

Gaseous exchange: O2 and CO2 transport, hypoxia and hyper- and hypocapnia, hyper- and hypobaric pressures
Pulmonary ventilation: volumes, flows, dead space. Effect of IPPV on lungs
Mechanics of respiration: ventilation/perfusion abnormalities
Regulation of respiration
Non-respiratory functions of the lungs

**Nervous System**

Functions of nerve cells and synaptic mechanisms
The brain: functional divisions - cortex, midbrain, medulla, limbic system, brain stem and cerebellum
Intracranial pressure: cerebrospinous fluid, blood flow
Maintenance of posture
Autonomic nervous system
Neurological reflexes
Motor function: spinal and peripheral
Senses: receptors, nociception, special senses
Pain: afferent nociceptive pathways, dorsal horn, peripheral and central mechanisms, neuromodulatory systems, supraspinal mechanisms, visceral pain, neuropathic pain, influence of therapy on nociceptive mechanisms
Spinal cord: anatomy and blood supply, effects of spinal cord section
Liver
Functional anatomy and blood supply
Metabolic functions
Gastrointestinal
Gut motility, sphincters and reflex control
Digestive functions

**Metabolism**

Nutrients: carbohydrates, fats, proteins, vitamins and minerals
Metabolic pathways, energy production and enzymes; metabolic rate
Hormonal control of metabolism: regulation of plasma glucose, response to trauma
Physiological alterations in starvation, obesity, exercise and the stress response
Body temperature and its regulation
**Endocrinology**

Mechanisms of hormonal control: feedback mechanisms, effect on membrane and intracellular receptors
Hypothalamic and pituitary function
Adrenocortical hormones
Adrenal medulla

**Pancreas**

Thyroid and parathyroid hormones and calcium homeostasis
Pregnancy
Physiological changes associated with normal pregnancy
Functions of the placenta: dynamics of placental transfer
Fetus: changes at birth
Candidates should have a good understanding of general pharmacological principles, together with knowledge of drugs likely to be encountered in (a) basic anaesthetic practice and (b) current treatment of patients presenting for anaesthesia.

**GENERAL PHARMACOLOGY**

Applied chemistry
Types of intermolecular bonds
Laws of diffusion. Diffusion of molecules through membranes
Solubility and partition coefficients
Ionization of drugs
Drug isomerism
Protein binding

**Mode of action of drugs**

Receptors:
Efficacy and potency. Receptor function and regulation. Tolerance
Metabolic pathways; enzymes; drug:enzyme interactions; Michaelis Menten equation
Ion channels:
Types of ion channels. Relation to receptors. Gating mechanisms. Types of drug action
Signal transduction: cell membrane/receptors/ion channels to intracellular molecular targets, second messengers
Membranes:
Action of gases and vapours
Other mechanisms:
Osmotic effects. pH effects. Adsorption and chelation. Oxidation and reduction
Mechanisms of drug interactions:
Inhibition and promotion of drug uptake. Competitive protein binding. Receptor interactions. Enzyme inducers and inhibitors. Addition, subtraction and synergism
Effects of metabolites and other degradation products.
Methodology of clinical trials
Pharmacokinetics

Drug uptake from the gastrointestinal tract
Presystemic metabolism: bioavailability
Drug uptake from the skin. Transdermal administration systems
Drug uptake by tissues:
Muscle, subcutaneous, CSF, extradural space. Factors determining the distribution of drugs: perfusion, molecular size, solubility, protein binding. Significance of drug uptake by the lung
The influence of drug formulation on disposition
Body compartments
Distribution of drugs to organs and tissues:
Influence of specialised membranes. Tissue binding and solubility. Materno-fetal distribution. Distribution in CSF and extradural space
Modes of drug elimination:
Direct excretion
Metabolism in organs of excretion: phase I & II
Non-organ breakdown of drugs
Pharmacokinetic analysis:
Concept of a pharmacokinetic compartment
Apparent volume of distribution
Clearance. Clearance concepts applied to whole body and individual organs
Relation to the Fick principle
Simple compartmental models
Physiological models based on perfusion and partition coefficients
Pharmacokinetic variation: influence of body size, sex, age, disease, pregnancy, anaesthesia, trauma, surgery, smoking, alcohol and other drugs
Pharmacodynamics: concentration-effect relationships. Hysteresis
Pharmacogenetics. Familial variation in drug response
Adverse reactions to drugs: hypersensitivity, allergy, anaphylaxis, anaphylactoid reactions

SYSTEMATIC PHARMACOLOGY

Anaesthetic gases and vapours
Hypnotics, sedatives and intravenous anaesthetic agents
Opioids and other analgesics
Non steroidal anti-inflammatory drugs
Neuromuscular blocking agents
Drugs acting on the autonomic nervous system: cholinergic and adrenergic agonists and antagonists
Drugs acting on the heart
Antihypertensives
Anticonvulsants
Diuretics
Antibiotics
Corticosteroids and other hormone preparations
Antacids. Drugs influencing gastric secretion and motility
Antiemetic agents
Local anaesthetic agents
Plasma volume expanders
Antihistamines
Antidepressants
Anticoagulants
Trainees should understand the physical principles upon which methods of clinical measurement are based. Knowledge of clinical measurement techniques should be limited to principles and basic method.

Mathematical concepts: sinusoids, exponentials and parabolas. Exponential functions and logarithms
Basic measurement concepts: linearity, drift, hysteresis, signal:noise ratio, dynamic response
SI units. Fundamental and derived units
Simple mechanics: Mass, Force, Work and Power
Freezing point, melting point. Latent heat. Vapour pressure. Colligative properties; osmometry
Basic concepts of electricity and magnetism. Capacitance, inductance and impedance
Amplifiers. Band width, filters. Amplification of biological potentials: ECG, EMG, EEG.
Sources of electrical interference
Processing, storage and display of physiological measurements. Bridge circuits
Basic principles of lasers
Principles of cardiac pacemakers and defibrillators
Electrical hazards: causes and prevention. Electrocuttion, fires and explosions.
Diathermy and its safe use
Principles of pressure transducers.
Resonance and damping, frequency response
Measurement of pressure. Direct and indirect methods of blood pressure measurement. Pulmonary artery pressure
Measurement of volume and flow in gases and liquids. The pneumotachograph and other respirometers. Peak flow measurement. Spirometry. Cardiac output
Measurement of temperature and humidity
Measurement of gas concentrations, especially oxygen, carbon dioxide, nitrogen, nitrous oxide, volatile anaesthetic agents
Measurement of pH, pCO2, pO2
Simple tests of pulmonary function
Capnography
Pulse oximetry
Measurement of neuromuscular blockade
Measurement of pain

**BASIC STATISTICS**

Candidates will be required to demonstrate understanding of basic statistical concepts, but will not be expected to have practical experience of statistical methods. Emphasis will be placed on methods by which data may be summarised and presented, and on the selection of statistical measures for different data types.

Candidates will be expected to understand the statistical background to measurement error and statistical uncertainty.
**Descriptive statistics**

Categories of data. Statistical distributions (Gaussian, c2, binomial) and their parameters. Non-parametric measures of location and variability. Graphical presentation of data

Deductive and inferential statistics

Simple probability theory. Confidence intervals. Linear regression. Linear correlation

The null hypothesis. Type I and type II errors. Probability of error occurrence, and the power of a test to detect a significant difference, Bland-Altman plot. Choice of simple statistical tests for different data types