
**CURRICULUM / STATUTES & REGULATIONS
FOR
5 YEARS DEGREE PROGRAMME
IN
ANAESTHESIOLOGY
(MS Anaesthesiology)**



UNIVERSITY OF HEALTH SCIENCES, LAHORE

STATUTES

Nomenclature Of The Proposed Course

The name of degree programme shall be MS Anaesthesiology. This name is well recognized and established for the last many decades worldwide.

Course Title:

MS Anaesthesiology

Training Centers

Department of Anaesthesiology (accredited by UHS) in affiliated institutes of University of Health sciences Lahore.

Duration of Course

The duration of MS Anaesthesiology course shall be five (5) years with structured training in a recognized department under the guidance of an approved supervisor.

Year 1 & 2:

After admission in MS Anaesthesiology Programme the first two years will offer:

- a. Introduction and orientation to anesthesiology during the 1st 6 months.
- b. Mandatory workshops (Appendix E).
- c. The research project will be designed and the synopsis be prepared during this period and submitted for approval by the AS&RB of the university.
- d. Core training in Anesthesia and the basic principles of Surgery and Medicine related to anesthesia. The training in the basic principles of General Surgery and Internal Medicine will be carried out in the department of Anaesthesia by the faculty of Anaesthesia.

At the end of 2nd Calender year the candidate shall take up Intermediate Examination.

Year 3, 4 & 5:

During Year 3 & 4 of the Program, there shall be focus on subspecialty anesthesia training. Year 5 will allow the resident to focus on subspecialty of interest and submit the final thesis before the final MS examination.

The candidate will undergo clinical training in the discipline to achieve the educational objectives (knowledge & Skills) along with rotation in all the

subspecialties of Anaesthesiology during the 3rd, 4th & 5th years of the programme. The clinical training shall be competency based. There shall generic

and specialty competencies and shall be assessed by continuous Internal Assessment. (Appendix F&G).

The Research & thesis Component shall be completed over the five years duration of the course. Research can be done as one block or it can be done as regular periodic rotation over five years.

Admission Criteria

Applications for admission to MS Training Programs will be invited through advertisement in print and electronic media mentioning closing date of applications and date of Entry Examination.

Eligibility: The applicant on the last date of submission of applications for admission must possess the:

- i) Basic Medical Qualification of MBBS or equivalent medical qualification recognized by Pakistan Medical & Dental Council.
- ii) Certificate of one year's House Job experience in institutions recognized by Pakistan Medical & Dental Council is essential at the time of interview. The applicant is required to submit House Certificate from the concerned Medical Superintendent that the House Job shall be completed before the Interview.
- iii) Valid certificate of permanent or provisional registration with Pakistan Medical & Dental Council.

Admission will be made through Central Induction policy of the Government of the Punjab in all PG Institutions.

Registration and Enrollment

- Total number of students enrolled for the course must not exceed 2 per supervisor/year.
- The maximum number of trainees that can be attached with a supervisor at a given point of time (inclusive of trainees in all years/phases of MS training), must not exceed 6.
- Beds to trainee ratio at the approved teaching site shall be at least 5 beds per trainee.
- The University will approve supervisors for MS courses.
- Candidates selected for the courses after their enrollment at the relevant institutions shall be registered with UHS as per prescribed Registration Regulation.
- Once a resident has joined an Anaesthesia training program, he will not be allowed to switch from Anaesthesia to another specialty as a result of upgradation.

Accreditation Related Issues of The Institution

A. Faculty

Properly qualified teaching staff in accordance with the requirements of Pakistan Medical and Dental Council (PMDC)

B. Adequate Space

Including class-rooms (with audiovisual aids), demonstration rooms, computer lab and clinical pathology lab etc.

C. Library

Departmental library should have latest editions of recommended books, reference books and latest journals (National and International).

- Accreditation of Anaesthesiology training program can be suspended on temporary or permanent basis by the University, if the program does not comply with requirements for residents training as laid out in this curriculum.
- Program should be presented to the University along with a plan for implementation of curriculum for training of residents.
- Programs should have documentation of residents training activities and evaluation on monthly basis.
- To ensure a uniform and standardized quality of training and availability of the training facilities, the University reserves the right to make surprise visits of the training program for monitoring purposes and may take appropriate action if deemed necessary.

AIMS AND OBJECTIVES OF THE COURSE

AIM

The aim of five years MS program in Anaesthesiology is to produce a trainee/ resident that demonstrate competencies in all six areas:

A. Patient Care and Procedural Skills

Trainee must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health.

Trainee:

Must demonstrate competence in fundamental clinical skills of medicine, including:

Obtaining a comprehensive medical history;

Performing a comprehensive physical examination;

Assessing a patient's medical conditions;

Making appropriate use of diagnostic studies and tests;

Integrating information to develop a differential diagnosis; and,

Implementing a treatment plan.

Must demonstrate competence in anesthetic management, including care for:

Patients younger than 12 years of age undergoing surgery or other procedures requiring anesthetics;

This experience must involve care for 100 patients younger than 12 years of age.

Within this patient group, 20 children must be younger than three years of age, including five younger than three months of age.

Patients who are evaluated for management of acute, chronic, or cancer-related pain disorders;

This experience must involve care for 20 patients presenting for initial evaluation of pain.

Trainee must be familiar with the breadth of pain management, including clinical experience with interventional pain procedures.

Patients scheduled for evaluation prior to elective surgical procedures;

Patients immediately after anesthesia, including direct care of patients in the post-anesthesia-care unit, and responsibilities for management of pain, hemodynamic changes, and emergencies related to the post-anesthesia care unit; and, critically-ill patients.

Trainee must be able to competently perform all medical, diagnostic, and surgical procedures considered essential for the area of practice.

Trainee:

Must achieve competence in the delivery of anesthetic care to:

Patients undergoing vaginal delivery; this experience must involve care for 40 patients.

Patients undergoing cesarean sections; this experience must involve care for 20 patients.

Patients undergoing cardiac surgery; this experience must involve care for 20 patients. The care provided to 10 of these patients must involve the use of cardiopulmonary bypass.

Patients undergoing non-cardiac intrathoracic surgery, including pulmonary surgery and surgery of the great vessels, esophagus, and the mediastinum and its structures; this experience must involve care for 20 patients.

Patients undergoing intracerebral procedures, including those undergoing intracerebral endovascular procedures; this experience must involve care for 20 patients, the majority of which must involve an open cranium.

Patients for whom epidural anesthetics are used as part of the anesthetic technique or epidural catheters are placed for peri-operative analgesia; this experience must involve care for 10 patients.

Patients undergoing procedures for complex, immediate life-threatening pathology; this experience must involve care for 20 patients.

Patients undergoing surgical procedures, including cesarean sections, with spinal anesthetics; this experience must involve care for 40 patients.

Patients undergoing surgical procedures in whom regional/peripheral nerve blocks are used as part of the anesthetic technique or peri-operative analgesic management; this experience must involve care for 10 patients.

Patients with acute post-operative pain, including those with patient-controlled intravenous techniques, neuraxial blockade, and other pain-control modalities;

Patients whose peri-operative care requires specialized techniques, including:

A broad spectrum of airway management techniques, to include laryngeal masks, fiberoptic intubation, and lung isolation techniques, such as double lumen endotracheal tube placement and endobronchial blockers;

Central vein access; this experience must involve care for 20 patients.

Arterial line access; this experience must involve care for 20 patients.

Patients undergoing a variety of diagnostic or therapeutic procedures outside the surgical suite.

B. Medical Knowledge

Trainee must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological and social- behavioral sciences, as well as the application of this knowledge to patient care.

Trainee:

Must demonstrate appropriate medical knowledge in the topics related to the anesthetic care of patients, including:

Practice management to address issues such as:

Operating room management;

Evaluation of types of practice;

Contract negotiations;

Billing arrangements;

Legislative and regulatory issues; and, fiscal stewardship of health services delivery.

Management of the specific needs of patients undergoing diagnostic or therapeutic procedures outside of the surgical suite.

C. Practice-based Learning and Improvement

Trainee must demonstrate the ability to investigate and

Evaluate their care of patients, to appraise and assimilate

Scientific evidence, and to continuously improve patient care

Based on constant self-evaluation and life-long learning.

Trainee are expected to develop skills and habits to be able to meet the following goals:

Identify strengths, deficiencies, and limits in one's knowledge and expertise;

Set learning and improvement goals;

identify and perform appropriate learning activities;

Systematically analyze practice using quality improvement methods, and implement changes with the goal of practice improvement;

Incorporate formative evaluation feedback into daily practice;

Locate, appraise, and assimilate evidence from scientific studies related to their patients' health problems;

Use information technology to optimize learning; and,

Participate in the education of patients, families, students, residents and other health professionals.

D. Interpersonal and Communication Skills

Trainee must demonstrate interpersonal and communication skills that result in the effective exchange of information and collaboration with patients, their families, and health professionals.

Trainee are expected to:

Communicate effectively with patients, families, and the public, as appropriate, across a broad range of socioeconomic and cultural backgrounds;

Communicate effectively with physicians, other health professionals, and health related agencies;

Work effectively as a member or leader of a health care team or other professional group;

Act in a consultative role to other physicians and health professionals; and, maintain comprehensive, timely, and legible medical records, if applicable.

Maintain a comprehensive anesthesia record for each patient, including evidence of pre- and post-operative anesthesia assessment, the drugs administered, the monitoring employed, the techniques used, the physiologic variations observed, the therapy provided, and the fluids administered; and, create and sustain a therapeutic relationship with patients, engage in active

listening, provide information using appropriate language, ask clear questions, provide an opportunity for comments and questions.

E. Professionalism

Trainee must demonstrate a commitment to carrying out professional responsibilities and an adherence to ethical principles.

Trainee are expected to demonstrate:

compassion, integrity, and respect for others;

Responsiveness to patient needs that supersedes self- interest;

Respect for patient privacy and autonomy;

Accountability to patients, society and the profession;

Sensitivity and responsiveness to a diverse patient population,

F. Systems-based Practice

Trainee must demonstrate an awareness of and responsiveness to the larger context and system of health care, as well as the ability to call effectively on other resources in the system to provide optimal health care.

Trainee is expected to:

Work effectively in various health care delivery settings and systems relevant to their clinical specialty;

Coordinate patient care within the health care system relevant to their clinical specialty;

Incorporate considerations of cost awareness and risk-benefit analysis in patient and/or population- based care as appropriate;

Advocate for quality patient care and optimal patient care systems;

Work in interprofessional teams to enhance patient safety and improve patient care quality; and,

Participate in identifying system errors and implementing potential systems solutions.

Curriculum Organization & Rotations

Anesthesia training in Year 1 & 2 will focus on the basic principles and skills, followed by Year 3&4 with subspecialty training and Year 5 will offer further subspecialty training. The training in basic principles of Surgery and Medicine related to Anaesthesia will be carried out in the Department of Anaesthesia by the faculty of Anaesthesia.

Core training in Anesthesia and Basic Principles of Surgery and Medicine :(First 2 years)

A. Introduction to Anesthesia (6 months):

1. Preoperative assessment
2. Premedication
3. Post-operative and recovery room care
4. Perioperative management of emergency patients
5. Induction of general anaesthesia
6. Intraoperative care
7. Infection control
8. Management of cardiac arrest in adults and children.
9. Mandatory workshops

10. Synopsis preparation.

B. Core Anaesthesia (18 months):

Basics of Surgery:

1. Basic Airway management & Critical incident management- 2week
2. Day surgery - 2 weeks
3. General Surgery & Trauma - 6 months
4. Urological Surgery- 1 month
5. Gynaecological surgery- 1 month
6. Head, neck, maxillo-facial and dental surgery - 2 weeks
7. Orthopaedic surgery -1 month

Basics of Medicine

1. Intensive care medicine - 2 months
2. Outside theatre - 2 weeks
3. Obstetrics - 3 months
4. Paediatrics- 2 months

Specialty training (Year 3 & 4) - Focus on Subspecialty training (24 months)

Essential units:

- 1. Anaesthesia for neurosurgery, neuroradiology and neurocritical care - 1 month**

- 2.** Cardiothoracic, Vascular & Thoracic Anaesthesia - **2** months
 - 3.** Intensive care medicine - 2 months
 - 4.** Day surgery- 2 weeks
 - 5.** General Surgery & Trauma and stabilisation - 5 months
 - 6.** Urological Surgery - 1 month
 - 7.** Gynaecological surgery - 1 month
 - 8.** Head, neck, maxillo-facial and dental surgery- 2 weeks
 - 9.** Outside theatre - 2week
 - 10.** Orthopaedic surgery - 1 month
 - 11.** Regional - 1 month
 - 12.** Sedation - 2 weeks
 - 13.** Obstetrics - 3 months
 - 14.** Paediatric - 3 months
 - 15.** Pain medicine - 1 month
- Minor Rotations:**
- 16.** Ophthalmic - 2 weeks
 - 17.** Plastics/burns - 2 weeks

Year 5 - Focused Advanced training

May elect to do up to 6 months in two of the following subspecialties:

1. Anaesthesia for Neurosurgery, Neuroradiology and Neurocritical care
2. Cardiothoracic anaesthesia and cardiothoracic critical care
3. Regional
4. Intensive care medicine
5. Obstetrics
6. Paediatric
7. Pain medicine
8. Plastics/burns.

Essential units throughout training:

Domain 1 – Clinical practice

Domain 2 – Team working

Domain 3 – Leadership

Domain 4 – Innovation

Domain 5 – Management

Domain 6 – Education

Non-clinical – Academic and Research, Improvement Science, Safe and Reliable Systems, Teaching and Learning, Management

REGULATIONS

Scheme of the Course

A summary of five years course in MS Anaesthesiology is presented as under:

Course Structure	Components	Examination
<p>End of 2nd Year of the Programme</p>	<p>Basic Principal of Surgery & Medicine related to core Anaesthesia (as outlined in the curriculum)</p>	<p>Intermediate examination at the end of 2nd year of MS Anaesthesiology programme.</p> <ul style="list-style-type: none"> • Written Paper MCQs= 100questions SEQs = 10 questions • Clinical, TOACS/OSCE & ORAL <ul style="list-style-type: none"> • Clinical Examination (Long case, Short cases • TOACS/OSCE & ORAL
<p>End of 5th Year of the Programme</p>	<p><u>Clinical component of M.S. Aesthesiology</u></p> <ul style="list-style-type: none"> • Professional Education in Anaesthesiology <p>Training in Anaesthesiology during 3rd, 4th & 5th year of MS Anaesthesiology programme, with compulsory & optional rotations in relevant fields</p> <p><u>Research component of M.S. Aesthesiology</u></p> <p>Research work/Thesis writing project must be completed and thesis be submitted atPleast 6 months before the end of training.</p>	<p>Final examination in specialized components of Anaesthesiology at the end of 5th year of MS Anaesthesiology programme.</p> <ul style="list-style-type: none"> • Written: Papers 1 & 2: Problem-based questions in the subject MCQs = 200 SEQs = 10 <li style="padding-left: 40px;">Paper 1 100 = MCQs 5 = SEQs <li style="padding-left: 40px;">Paper 2 100 = MCQs 5 = SEQs • Clinical, TOACS/OSCE & ORAL Clinical Examination (Long case, Short cases) <ul style="list-style-type: none"> • Oral Exam • Continuous Internal Assessment <p>Thesis examination with defense at the end of fifth (5th) year of MS Anaesthesiology programme.</p>

Intermediate Examination M .S. Anaesthesiaology

All candidates admitted in M.S. Anaesthesiaology course shall appear in Intermediate Examination at the end of 2nd calendar year.

Eligibility Criteria: The candidate of M.S. Anaesthesiaology appearing in Intermediate Examination of the Programme are required.

- a) To have submitted certificate of completion of mandatory workshops.
- b) To have submitted certificate of completion of first two years of training from the supervisor/ Supervisors of rotations.
- c) To have submitted CIS assessment proforma from his/her own supervisor on 03 monthly basis and also from his/her supervisors during rotation, achieving a cumulative score of 75%.
- d) To have submitted certificate of approval of synopsis or undertaking / affidavit that if synopsis not approved with 30 days of submission of application for the Intermediate Examination, the candidate will not be allowed to take the examinations and shall be removed from the training programme.
- e) To have submitted evidence of payment of examination fee.

Intermediate Examination Schedule and Fee

- a) Intermediate Examination at completion of two years training, will be held twice a year.
- b) There will be a minimum period of 30 days between submission of application for the examination and the conduction of examination.

- c) Examination fee will be determined periodically by the University.
- d) The examination fee once deposited cannot be refunded / carried over to the next examination under any circumstances.
- e) The Controller of Examinations will issue Roll Number Slips on receipt of prescribed application form, documents satisfying eligibility criteria and evidence of payment of examination fee.

Written Part of Intermediate Examination

MCQs =	100 questions
SEQs =	10 questions
	50% Principals of Internal Medicine
	50% Principals of General Surgery
Total Marks =	300

Clinical, TOACS/OSCE & ORAL

4 Short Courses =	100 Marks
1 Long Course =	50 Marks
TOACS/OSCE & ORAL =	50 Marks
Total =	200

Declaration of Results

The Candidate will have to score 50% marks in written, clinical and Toacs/OSCE & Oral components and a cumulative score of 60% to be declared successful in the Intermediate Examination.

A maximum of four consecutive attempts (availed or unavailed) will be allowed in the Intermediate Examination during which the candidate will be allowed to continue his training program. If the candidate fails to pass his Intermediate Examination within the above mentioned limit of four attempts, the candidate shall be removed from the training program, and the seat would fall vacant, stipend/ scholarship if any would be stopped.

**Final Examination M.S. Anaesthesiology
(at the end of 5th year of the Programme)**

Eligibility Criteria:

To appear in the Final Examination the candidate shall be required:

- i) To have submitted the result of passing Intermediate Examination.
- ii) To have submitted the certificate of completion of training, issued by the Supervisor which will be mandatory.
- iii) To have achieved a cumulative score of 75% in Continuous Internal assessments of all training years.
- iv) To have got the thesis accepted and will then be eligible to appear in Final Examination.
- v) To have submitted no dues certificate from all relevant departments including library, hostel, cashier etc.
- vi) To have submitted evidence of submission of examination fee.

Final Examination Schedule and Fee

- a) Final examination will be held twice a year.
- b) The candidates have to satisfy eligibility criteria before permission is granted to take the examination.
- c) Examination fee will be determined and varied at periodic intervals by the University.
- d) The examination fee once deposited cannot be refunded / carried over to the next examination under any circumstances.
- e) The Controller of Examinations will issue an Admittance Card with a photograph of the candidate on receipt of prescribed application form,

documents satisfying eligibility criteria and evidence of payment of examination fee. This card will also show the Roll Number, date / time and venue of examination.

Components of Final Examination

Written Part of Final Examination	Total marks 500
Clinical & Toacs/OSCE & Oral	Total marks 500
Contribution of CIS to the Final Examination	Total marks 100
Thesis Evaluation	Total marks 400

Written Part of Final Examination

- a) There will be two written papers which will cover the whole syllabus of the specialty of training with total marks of 500.
- b) The written examination will consist of 200 single best answer type Multiple Choice Questions (MCQs) and 10 Short Essay Questions (SEQs). Each correct answer in the Multiple Choice Question paper will carry 02 marks, but an incorrect response will result in deduction of 0.5 marks. Each Short Essay Question will carry 10 marks.
- c) The Total Marks of the Written Examination will be 500 to be divided as follows:
 - Multiple Choice Question paper Total Marks = 400
 - Short Essay Question paper Total Marks = 100
- d) The candidates scoring 50% marks in multiple choice question paper and short essay question paper will pass the written part of the final

examination and will become eligible to appear in the clinical and oral examination.

- e) The written part result will be valid for three consecutive attempts for appearing in the Clinical and Oral Part of the Final Examination. After that the candidate shall have to re-sit the written part of the Final Examination.

Clinical and Toacs/OSCE & Oral

- a) The Clinical and Oral Examination will consist of 04 short cases, 01 long case and Oral Examination with 01 station for a pair of Internal and External Examiner Each short case will be of 07 minutes duration, 05 minutes will be for examining the patient and 02 minutes for discussion. The Oral Examination will consist of laboratory data assessment, interpretation of Radiology images, ECG and others.
- b) The Total Marks of Clinical & Oral Examination will be 500 and to be divided as follows:

Short Cases	Total Marks = 200
Long Case	Total Marks = 100
TOACS/OSCE & ORAL	Total Marks = 200

- c) A panel of four examiners will be appointed by the Vice Chancellor and of these two will be from UHS whilst the other two will be the external examiners. Internal examiner will act as a coordinator. In case of difficulty in finding an Internal Examiner in a given subject, the Vice Chancellor would, in consultation with the concerned Deans, appoint any relevant person with appropriate qualification and experience, outside the University as an examiner.

- d) The internal examiners will not examine the candidates for whom they have acted as Supervisor and will be substituted by other internal examiner.
- e) The candidates scoring 50% marks in each component of the Clinical & Oral Examination will pass this part of the Final Examination.
- f) The candidates will have two attempts to pass the final examination with normal fee. A special administration fee of Rs.10,000 in addition to normal fee or the amount determined by the University from time to time shall be charged for further attempts.

Declaration of Result

For the declaration of result

- I. The candidate must get his/her Thesis accepted.
- II. The candidate must have passed the final written examination with 50% marks and the clinical & oral examination securing 50% marks. The cumulative passing score from the written and clinical/ oral examination shall be 60%. Cumulative score of 60% marks to be calculated by adding up secured marks of each component of the examination i.e written and clinical/ oral and then calculating its percentage.
- III. The MS degree shall be awarded after acceptance of thesis and success in the final examination.
- IV. On completion of stipulated training period, irrespective of the result (pass or fail) the training slot of the candidate shall be declared vacant.

Submission / Evaluation of Synopsis

1. The candidates shall prepare their synopsis as per guidelines provided by the Advanced Studies & Research Board, available on university website.
2. The research topic in clinical subject should have 30% component related to basic sciences and 70% component related to applied clinical sciences. The research topic must consist of a reasonable sample size and sufficient numbers of variables to give training to the candidate to conduct research, to collect & analyze the data.
3. Synopsis of research project shall be submitted by the end of the 2nd year of MS program. The synopsis after review by an Institutional Review Committee, shall be submitted to the University for consideration by the Advanced Studies & Research Board, through the Principal / Dean / Head of the institution.

Submission of Thesis

1. Thesis shall be submitted by the candidate duly recommended by the Supervisor.
2. The minimum duration between approval of synopsis and submission of thesis shall be one year.
3. The research thesis must be compiled and bound in accordance with the Thesis Format Guidelines approved by the University and available on website.
4. The research thesis will be submitted along with the fee prescribed by the University.

Thesis Examination

- a) The candidate will submit his/her thesis at least 06 months prior to completion of training.
- b) The Thesis along with a certificate of approval from the supervisory will be submitted to the Registrar's office, who would record the date / time etc. and get received from the Controller of Examinations within 05 working days of receiving.
- c) The Controller of Examinations will submit a panel of eight examiners within 07 days for selection of four examiners by the Vice Chancellor. The Vice Chancellor shall return the final panel within 05 working days to the Controller of Examinations for processing and assessment. In case of any delay the Controller of Examinations would bring the case personally to the Vice Chancellor.
- d) The Supervisor shall not act as an examiner of the candidate and will not take part in evaluation of thesis.

- e) The Controller of Examinations will make sure that the Thesis is submitted to examiners in appropriate fashion and a reminder is sent after every fifteen days.
- f) The thesis will be evaluated by the examiners within a period of 06 weeks.
- g) In case the examiners fail to complete the task within 06 weeks with 02 fortnightly reminders by the Controller of Examinations, the Controller of Examinations will bring it to the notice of Vice Chancellor in person.
- h) In case of difficulty in find an internal examiner for thesis evaluation, the Vice Chancellor would, in consultation with the concerned Deans, appoint any relevant person as examiner in supersession of the relevant Clause of the University Regulations.
- i) There will be two internal and two external examiners. In case of difficulty in finding examiners, the Vice Chancellor would, in consultation with the concerned Deans, appoint minimum of three, one internal and two external examiners.
- j) The total marks of thesis evaluation will be 400 and 60% marks will be required to pass the evaluation.
- k) The thesis will be considered / accepted, if the cumulative score of all the examiners is 60%.
- l) The clinical training will end at completion of stipulated training period but the candidate will become eligible to appear in the Final Examination at completion of clinical training and after acceptance of thesis. In case clinical training ends earlier, the slot will fall vacant after stipulated training period.

Award of MS Anaesthesiology Degree

After successful completion of the structured courses of MS Anaesthesiology and qualifying Intermediate and Final examinations (written, Clinical, TOACS/OSCE & ORAL and Thesis), the degree with title MS Anaesthesiology shall be awarded.

CURRICULUM

TABLE OF CONTENTS

For Intermediate Module

I. Basic Principles of Surgery & Medicine related to Anesthesia

A. BASIC SCIENCES

- I.A.1 Anatomy
- I.A.2 Physics, Monitoring, and Anesthesia Delivery Devices
- I.A.3 Mathematics
- I.A.4 Pharmacology

B. CLINICAL SCIENCES:

Anesthesia Procedures, Methods, and Techniques

- I.B.1 Evaluation of the Patient and Preoperative Preparation.
- I.B.2 Regional Anesthesia
- I.B.3 General Anesthesia
- I.B.4 Monitored Anesthesia Care and Sedation
- I.B.5 Intravenous Fluid Therapy During Anesthesia
- I.B.6 Complications (Etiology, Prevention, Treatment)
- I.B.7 Postoperative Period

C. ORGAN-BASED BASIC AND CLINICAL SCIENCES

- I.C.1 Central and Peripheral Nervous Systems

- I.C.2 Respiratory System
- I.C.3 Cardiovascular System
- I.C.4 Gastrointestinal / Hepatic Systems
- I.C.5 Renal and Urinary Systems/ Electrolyte Balance
- I.C.6 Hematologic System
- I.C.7 Endocrine and Metabolic Systems
- I.C.8 Neuromuscular Diseases and Disorders

D. SPECIAL PROBLEMS OR ISSUES IN ANESTHESIOLOGY

- I.D.1 Physician Impairment or Disability: Substance Abuse, Fatigue, Aging, Visual and Auditory Impairment
- I.D.2 Ethics, Practice Management, and Medicolegal Issues

FOR FINAL EXAMINATION

II. Advanced Topics in Anesthesiology

A. BASIC SCIENCES

- II.A.1 Physics, Monitoring, and Anesthesia Delivery Devices
- II.A.2 Pharmacology

B. CLINICAL SCIENCES: Anesthesia Procedures, Methods, and Techniques.

- II.B.1 Regional Anesthesia
- II.B.2 Special Techniques

C. ORGAN-BASED BASIC AND CLINICAL SCIENCES.

- II.C.1 Central and Peripheral Nervous Systems
- II.C.2 Respiratory System
- II.C.3 Cardiovascular System
- II.C.4 Gastrointestinal / Hepatic Systems
- II.C.5 Renal and Urinary Systems / Electrolyte Balance: Clinical Science
- II.C.6 Hematologic System
- II.C.7 Endocrine and Metabolic Systems: Clinical Science
- II.C.8 Neuromuscular Diseases and Disorders: Clinical Science

D. CLINICAL SUBSPECIALTIES.

- II.D.1 Painful Disease States
- II.D.2 Pediatric Anesthesia
- II.D.3 Obstetric Anesthesia
- II.D.4 Otorhinolaryngology (ENT) Anesthesia: Airway Endoscopy; Microlaryngeal Surgery; Laser Surgery, Hazards, Complications (Airway Fires, Etc.)
- II.D.5 Anesthesia for Plastic Surgery, Liposuction

- II.D.6 Anesthesia for Laparoscopic Surgery; Cholecystectomy; Gynecologic Surgery; Gastric Stapling; Hiatus Hernia Repair; Anesthetic Management; Complications
- II.D.7 Ophthalmologic Anesthesia, Retrobulbar and Peribulbar Blocks; Open Eye Injuries
- II.D.8 Orthopedic Anesthesia; Tourniquet Management, Complications, Regional vs. General Anesthesia
- II.D.9 Trauma Anesthesia
- II.D.10 Anesthesia for Ambulatory Surgery
- II.D.11 Geriatric Anesthesia/Aging
- II.D.12 Critical Care

E. SPECIAL PROBLEMS OR ISSUES IN ANESTHESIOLOGY

- II.E.1 Electroconvulsive Therapy
- II.E.2 Organ Donors: Pathophysiology and Clinical Management
- II.E.3 Radiologic Procedures; CT Scan; MRI-Anesthetic Implications/Management, Anesthesia in Locations Outside the Operating Rooms
- II.E.4 Ethics, Practice Management, and Medicolegal Issues

Basic Topics in Anesthesiology

A. Basic Sciences

1. Anatomy

a. Topographical Anatomy as Landmarks

- 1) Neck: Cricothyroid Membrane, Internal and External Jugular Veins, Thoracic Duct, Carotid and Vertebral Arteries, Stellate Ganglion, Cervical Spine Landmarks (Vertebra Prominens, Chassaignac's Tubercle)
- 2) Chest: Pulmonary Lobes, Cardiac Landmarks, Subclavian Vein
- 3) Pelvis and Back: Vertebral Level of Topographical Landmarks, Caudal Space
- 4) Extremities: Relationship of Bones, Nerves, and Arteries
- 5) Dermatome Anatomy: Sensory and Motor

b. Radiological Anatomy

- 1) Chest (Including CT and MRI)
- 2) Brain and Skull (Including CT and MRI)
- 3) Spine (Cervical, Thoracic, Lumbar), Including CT and MRI
- 4) Neck (Including Doppler Ultrasound for Central Venous Access)

c. Clinical Anatomy

1) Upper Extremity

- a) Bones
- b) Vasculature
- c) Innervation

2) Lower Extremity

- a) Bones

- b) Vasculature

- c) Innervation

2. Physics, Monitoring, and Anesthesia Delivery Devices

a. Mechanics

- 1) Pressure Measurement of Gases, Liquids

- 2) Transducers, Regulators, Medical Gas Cylinders

3) Principles of Ultrasound: Obtaining an Image, Resolution, Depth, Frequency, Resonance b. Flow Velocity

- 1) Viscosity-Density; Laminar-Turbulent Flow 2) Flowmeters: Rotameter
- 3) Principles of Doppler Ultrasound

I.A.2

c. Properties of Liquids, Gases, and Vapors

- 1) Diffusion of Gases
- 2) Solubility Coefficients
- 3) Relative and Absolute Humidity
- 4) Critical Temperature, Critical Pressure d. Gas Laws

e. Vaporizers

- 1) Vapor Pressure and Calculation of Anesthetic Concentrations 2) Vaporizer Types and Safety Features

f. Uptake and Distribution of Inhalation Agents

- 1) Uptake and Elimination Curves; Effect of Ventilation, Circulation, Anesthetic Systems 2) Concentration Effect
- 3) Second Gas Effect
- 4) Nitrous Oxide and Closed Spaces

g. Physics of Anesthesia Machine/ Breathing System

- 1) Principles: Resistance, Turbulent Flow, Mechanical Deadspace, Rebreathing, Dilution, Leaks, Gas Mixtures, Humidity, Heat
- 2) Components: Connectors, Adaptors, Mask, Endotracheal Tube, Reservoir Bag Unidirectional Valves, Corrugated Breathing Tubes, Laryngeal Mask Airways, Airway Pressure Relief Valve
- 3) Characteristics
 - a) Circle Systems: Closed and Semi-Closed; Adult; Pediatric

- b) Non-Circle Systems: Insufflation; Open; Semi-Open
- c) Portable Ventilation Devices (Self-Reinflating, Non-Self-Reinflating), Non-Rebreathing Valves
- d) CO₂ Absorption: Principles, Canisters, Efficiency

e) Toxicity: Compound A, Carbon Monoxide

- 4) Oxygen Supply Systems: FiO₂
- 5) Waste Gas Evacuation Systems
- 6) Safety Features (Proportioning Devices, Rotameter Configuration, Pressure Fail-Safe)

h. Monitoring Methods

- 1) Neuromuscular Function: Nerve Stimulators, Electromyography (Emg)
- 2) Ventilation: Respirometers, Inspiratory Force, Spirometry, Flow-Volume Loops
- 3) Gas Concentrations: O₂, CO₂, Nitrogen, Anesthetic Gases and Vapors
- 4) Temperature
- 5) Oxygen: Oximetry, Co-Oximetry, Pulse Oximetry

I.A.2.h

- 6) Blood Pressure - Noninvasive, Invasive
- 7) Heart Function: Heart Tones, Electrocardiogram i. Instrumentation
 - 1) Arterial and Venous Blood Gases: Electrodes for pH, PO₂, PCO₂, Calibration, Temperature Corrections, Errors
 - 2) Gas Concentrations: Infrared Absorption, Mass Spectrometry, Raman Scatter Analysis
 - 3) Pressure Transducers: Resonance, Damping
 - 4) Non-Invasive Blood Pressure (BP) Measurement: Doppler, Oscillometry, Korotkoff Sounds, Palpation

5) Blood Warmers, Autotransfusion Devices

6) Body Warming Devices: Forced Air, Heating Lamps, Insulation Devices, Warming Blankets, Water-Flow "Second Skin" Devices

j. Ventilators

1) Classifications: Flow Generation vs. Pressure Generation

2) 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: Biphase Positive Airway Pressure (BIPAP), Others

3) Monitors; Pressure (Plateau, Peak), Oxygen, Apnea, Inspiratory/Expiratory Ratio, Dynamic Compliance, Static Compliance

k. Alarms and Safety Features: Operating Room, Electrical, Anesthesia Machine, Ventilators, Capnometer, Oxygen, Hemodynamic Monitors

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

m. Electrical; Fire and Explosion Hazards; Basic Electronics

1) Source of Ignition; Static

2) Prevention: Grounding, Isolation Transformers

3) Macro and Micro Current Hazards

4) Safety Regulations; National Fire Protection Association (NFPA) Standards

5) Risk Factors for Intraoperative Fire

3. Mathematics
a. Simple Math: Logarithms; Graph of Simple Equations; Exponential Function, Analysis of Biologic Curves

b. 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 Intervals, Odds Ratio, Risk Ratio, Bland-Altman Plot

I.A

4. Pharmacology

a. General Concepts

1) Pharmacokinetics and Pharmacodynamics, Protein Binding; Partition Coefficients; PKA; Ionization; Tissue Uptake; Compartmentalization and Exponential Models

a) Pharmacokinetics of Neuraxial Drug Administration: Epidural and Subarachnoid

b) Tolerance and Tachyphylaxis 2) Termination of Action

a) Elimination; Biotransformation; Context-Sensitive Half-Time

b) Impact of Renal Disease

c) Impact of Hepatic Disease

3) Drug Interactions

a) Enzyme Induction and Inhibition

b) Hepatic Blood Flow

c) Drug-Drug Binding

d) Alternative and Herbal Medicines: Perioperative Implications

4) Drug Reactions (Anaphylactoid, Anaphylaxis, Idiosyncratic)

b. Anesthetics-Gases and Vapors

1) Physical Properties

2) Mechanism of Action

3) Effects on Central Nervous System (CNS)

4) Effects on Cardiovascular System

5) Effects on Respiration

6) Effects on Neuromuscular Function

7) Effects on Renal Function

- 8) Effects on Hepatic Function
- 9) Effects on Hematologic and Immune Systems
- 10) Biotransformation and Toxicity
- 11) Minimum Alveolar Concentration (MAC), Factors Affecting Mac
- 12) Trace Concentrations, OR Pollution, Personnel Hazards
- 13) Comparative Pharmacodynamics

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

1) Opioids

- a) Mechanism of Action
- b) Pharmacokinetics and Pharmacodynamics

(1) Intravenous

I.A.4.c.1.b

(2) Epidural and Intrathecal

- a) Metabolism and Excretion
- b) Effect on Circulation
- c) Effect on Respiration
- d) Effect on Other Organs
- e) Side Effects and Toxicity
- f) Indications and Contraindications

2) Barbiturates

- a) Mechanism of Action
- b) Pharmacokinetics and Pharmacodynamics
- c) Metabolism and Excretion
- d) Effect on Circulation
- e) Effect on Respiration
- f) Effect on Other Organs

- g) Side Effects and Toxicity
- h) Indications and Contraindications

3) Propofol

- a) Mechanism of Action
- b) Pharmacokinetics and Pharmacodynamics
- c) Metabolism and Excretion
- d) Effect on Circulation
- e) Effect on Respiration
- f) Effect on Other Organs
- g) Side Effects and Toxicity
- h) Indications and Contraindications

4) Etomidate

- a) Mechanism of Action
- b) Pharmacokinetics and Pharmacodynamics
- c) Metabolism and Excretion
- d) Effect on Circulation
- e) Effect on Respiration
- f) Effect on Other Organs
- g) Side Effects and Toxicity
- h) Indications and Contraindications

I.A.4.c

5) Benzodiazepines

- a) Mechanism of Action
- b) Pharmacokinetics and Pharmacodynamics
- c) Metabolism and Excretion
- d) Effect on Circulation
- e) Effect on Respiration
- f) Effect on Other Organs

- g) Side Effects and Toxicity
- h) Indications and Contraindications
- i) Antagonism

6) Ketamine

- a) Mechanism of Action
- b) Pharmacokinetics and Pharmacodynamics
- c) Metabolism and Excretion
- d) Effect on Circulation
- e) Effect on Respiration
- f) Effect on Other Organs
- g) Side Effects and Toxicity
- h) Indications and Contraindications

7) Dexmedetomidine

- a) Mechanism of Action
- b) Pharmacokinetics and Pharmacodynamics
- c) Metabolism and Excretion
- d) Effect on Circulation
- e) Effect on Respiration
- f) Effect on Other Organs
- g) Side Effects and Toxicity
- h) Indications and Contraindications

d. Anesthetics - Local

- 1) Uptake, Mechanism of Action
- 2) Biotransformation and Excretion
- 3) Comparison of Drugs and Chemical Groups
- 4) Prolongation of Action
- 5) Local Anesthetic Side Effects
- a) CNS: Seizures, Cauda Equina Syndrome, Transient Neurological Symptom

I.A.4.d.5

- b) Cardiac
- c) Allergy
- d) Preservatives/Additives
- e) Methemoglobinemia
- f) Local Anesthetic Systemic Toxicity

i. American Society for Regional Anesthesia Checklist for Local Anesthetic Systemic

Toxicity

ii. Intravenous Lipid Emulsion for Local Anesthetic Systemic Toxicity

e. Muscle Relaxants (Depolarizing, Non-Depolarizing)

- 1) Mechanism of Action
- 2) Pharmacokinetics and Pharmacodynamics, Abnormal Responses
- 3) Prolongation of Action; Synergism
- 4) Metabolism and Excretion
- 5) Side Effects and Toxicity
- 6) Indications and Contraindications
- 7) Antagonism of Blockade
- 8) Drug Interactions (Antibiotics, Antiepileptics, Lithium, Magnesium, Inhalational Anesthetics)

B. Clinical Sciences: Anesthesia Procedures, Methods, and Techniques

1. Evaluation of the Patient and Preoperative Preparation

a. Physical Examination Including Airway Evaluation b. Laboratory Evaluation

1) American Society of Anesthesiologists (ASA) Preoperative Testing Guidelines

2) American College of Cardiology/American Heart Association Guidelines for Perioperative Cardiovascular Evaluation

- c. ASA Physical Status Classification
- d. Preparation for Anesthesia/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, Obstructive Sleep Apnea, Depression, COPD, Hypertension
- 4) Pediatric and Geriatric Doses, Routes of Administration
- 5) Role in Patients with Allergies
- 6) NPO and Full Stomach Status; Implications for Airway Management, Choice of Anesthesia Technique and Induction of Anesthesia; Gastric Emptying Time; Preoperative; Full Stomach and Induction of Anesthesia; Practice Guidelines for Preoperative Fasting
 - a) Alteration of Gastric Fluid Volume and pH, Sphincter Tone

I.B.1.d

- 7) Continuation vs. Discontinuation of Chronic Medications: Antihypertensives, Anti-Anginal, Antihyperglycemics, Antidepressants, Platelet Inhibitors, Etc.
- 8) Prophylactic Cardiac Risk Reduction: Beta-Adrenergic Blockers, Etc.
- 9) Prophylactic Antibiotics
 - a) Indications
 - b) Risks of Administration
 - c) Drug Interactions

2. Regional Anesthesia

a. General Topics: Premedication, Patient Position, Equipment, Monitoring and Sedation

b. Spinal, Epidural, Caudal, Combined Spinal/Epidural

1) Indications, Contraindications

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

6) Physiologic Effects (GI, Pulmonary, Cardiac, Renal)

c. IV Regional: Mechanism, Agents, Indications, Contraindications, Techniques, Complications

d. Transversus Abdominis Plane Blocks: Indications, Risks, Side Effects

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, Alternative Intubating Devices, Video Laryngoscopes

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, Placement and Positioning Considerations, Postoperative Considerations

7) Intubation and Tube Change Adjuncts: Bougies, Jet Stylettes, Soft and Rigid Tube Change Devices; Complications

I.B.3.c

8) Endotracheal Tube Types: Tube Material (Polyvinyl Chloride, Silicone, Laser-Resistant, Silver Impregnated, Other), Tube Tip Design (Murphy Eyes, Flexible Tip, Moveable Tip, Short- Bevel), Cuff Design (High vs. Low Volume/Pressure, Cuffed Vs Uncuffed, Cuff Shape), Cuff Pressure Management (Lanz Valves, Active Management, Pilot Balloon, Inflation Valve), Specific Tube Types (Wire-Reinforced, Nasal and Oral Rae®, Microlaryngeal, Supraglottic Secretion Suctioning, Other), Microlaryngoscopy; Laser Safe

d. ASA Monitoring Standards

4. Monitored Anesthesia Care and Sedation

a. Techniques

b. Risks and Complications

c. ASA Guidelines for Sedation, Sedation Guidelines for Non-Anesthesiologists d. Indications/Contraindications

5. Intravenous Fluid Therapy During Anesthesia

a. Water, Electrolyte, Glucose Requirements and Disposition

b. Crystalloid vs. Colloid

c. Fluid Requirements and Fluid Deficit Calculations

d. Normal Saline vs. Lactated Ringers' vs. Plasmalyte vs. D5W e. Enhanced Recovery After Surgery Protocol for Fluid Therapy

6. Complications (Etiology, Prevention, Treatment) a. Trauma

- 1) Upper Airway, Epistaxis
- 2) Larynx, Trachea, and Esophagus
- 3) Eyes: Corneal Abrasions, Blindness, Post-op visual loss
- 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

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 e. Anaphylaxis

1) Latex Allergy 2) Other

I.B.6

f. Laryngospasm

g. Postobstructive Pulmonary Edema h. Aspiration of Gastric Contents

i. Malignant Hyperthermia

1) Genetics

2) Pathophysiology 7. 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, tricyclic antidepressants (TCA), selective serotonin reuptake inhibitor (SSRI)

b) Routes: Oral, Subcutaneous (SC), Transcutaneous, Transmucosal, Intramuscular (IM), Intravenous (IV), Including Patient-Controlled Analgesia (PCA), Epidural, Spinal, Interpleural, Other Regional Techniques

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. Nausea and Vomiting

1) Physiology; Etiology; Risk Factors, Preventive Strategies

2) Use of Antacids, Histamine-2 (H2) Blockers, Metoclopramide, Transdermal Scopolamine, Droperidol, Serotonin Antagonists, Proton Pump Inhibitors, Dexamethasone, Multimodal Therapy, Acupressure/Acupuncture

e. Neuromuscular Consequences: Residual Paralysis, Muscle Soreness, Recovery of Airway Reflexes

f. Neurologic Consequences of Anesthesia: Confusion, Delirium, Cognitive Dysfunction, Failure to emerge from anesthesia

C. Organ-Based Basic and Clinical Sciences

1. Central and Peripheral Nervous Systems

a. Physiology 1) Brain

a) Cerebral Cortex; Functional Organization

b) Subcortical Areas: Basal Ganglia, Hippocampus, Internal Capsule, Cerebellum, Brain Stem, Reticular Activating System

c) Cerebral Blood Flow

(1) Effect of Perfusion Pressure, Ph, PaCO₂, PaO₂, and Cerebral Metabolic Rate for O₂ (CMRO₂); Inverse Steal; Gray vs. White Matter

I.C.1.a.1.c

(2) Autoregulation: Normal, Altered, and Abolished

(3) Pathophysiology of Ischemia/Hypoxia: Global vs. Focal, Glucose Effects, Effects of Brain Trauma or Tumors

d) Cerebrospinal Fluid

(1) Formation, Volume, Composition, Flow and Pressure

(2) Blood-Brain Barrier, Active and Passive Molecular Transport Across, Causes of Disruption

(3) Relation to Blood Chemistry and Acid-Base Balance e) Cerebral Protection

(1) Hypothermia

(2) Anesthetic and Adjuvant Drugs 2) Spinal Cord

a) General Organization b) Spinal Reflexes

c) Spinal Cord Tracts

d) Evoked Potentials

3) Neuromuscular and Synaptic Transmission

a) Morphology; Receptors, Receptor Density

b) Membrane Potential; Mechanism

c) Action Potential; Characteristics, Ion Flux

d) Synapse; Transmitters, Precursors, Ions, Termination of Action, Transmission Characteristics, Presynaptic and Postsynaptic Functions

4) Skeletal Muscle Contractions; Depolarization, Role of Calcium, Actin/Myosin; Energy Source and Release

5) Pain Mechanisms and Pathways

- a) Nociceptors and Nociceptive Afferent Neurons, Wind-Up Phenomenon
- b) Dorsal Horn Transmission and Modulation
- c) Spinal and Supraspinal Neurotransmission and Modulation; Opioid Receptors
- d) Autonomic Contributions to Pain; Visceral Pain Perception and Transmission
- e) Social, Vocational and Psychological Influences on Pain Perception
- f) Gender and Age Differences in Pain Perception

6) Autonomic Nervous System

- a) Sympathetic: Receptors; Transmitters, Synthesis; Storage; Release; Responses; Termination of Action
- b) Parasympathetic: Receptors; Transmitters; Synthesis; Release; Responses; Termination of Action
- c) Ganglionic Transmission

I.C.1.a.6

d) Reflexes: Afferent and Efferent Limbs 7) Temperature Regulation

- a) Temperature Sensing; Central, Peripheral
- b) Temperature Regulating Centers; Concept of Set Point
- c) Heat Production and Conservation
- d) Heat Loss; Mechanisms
- e) Body Temperature Measurement; Sites; Gradients
- f) Effect of Drugs/Anesthesia on Temperature Regulation

b. Anatomy 1) Brain

- a) Cerebral Cortex
 - (1) Cerebellum, Basal Ganglia, Major Nuclei and Pathways
 - (2) Brain Stem
 - (a) Respiratory Centers

- (b) Reticular Activating System
- (3) Cerebral Circulation; Circle of Willis, Venous Sinuses and Drainage

2) Spinal Cord and Spine

- a) Variations in Vertebral Configuration
- b) Spinal Nerves (Level of Exit, Covering, Sensory Distribution)
- c) Blood Supply
- d) Sacral Nerves: Innervation of Pelvic Structures

3) Meninges: Epidural, Subdural and Subarachnoid Spaces

4) Parasympathetic Nervous System: Location of Ganglia, Vagal Reflex Pathways

5) Sympathetic Nervous System: Ganglia, Rami Communicantes, Sympathetic Chain

a) Cranial Nerves

b) Carotid and Aortic Bodies, Carotid Sinus

c) Ganglia, Rami Communicantes, Sympathetic Chain

d) Nociception

(1) Peripheral Nociceptors: Transduction

(2) Afferent Pathways: Neurons, Dorsal Horn, CNS Pathways

2. Respiratory System

a. Physiology: Lung Functions and Cellular Processes

1) Lung Volumes

a) Definitions; Methods of Measurement; Normal Values; Time Constants

I.C.2.a.1

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)

Alveolar Gas Equation

4) Diffusion

a) Definition, Pulmonary Diffusion Capacity b) Apneic Oxygenation, Diffusion Hypoxia

5) Blood Gas

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 e) Basic Interpretation of Arterial Blood Gas

6) Control 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 8) Perioperative Smoking

a) Physiologic effects

b) Cessation of smoking b. Anatomy

- 1) Nose
- 2) Pharynx: Subdivisions; Innervation

I.C.2.b

- 3) Larynx
 - a) Innervation; Muscles; Blood Supply; Cartilages
 - b) Vocal Cords, Positions with Paralysis
 - c) Differences Between Infant and Adult
- 4) Trachea
 - a) Structure and Relationships in Neck and Chest
- 5) Muscles of Respiration, Accessory Muscles c. Pharmacology

- 1) Bronchodilators
 - a) β -agonists
 - b) Anticholinergics
- 2) Antiinflammatory medications
 - a) Steroids
 - b) Leukotriene modifier drugs
 - c) Mast cell stabilizers
 - d) Immunoglobulin E (IgE) blockers

3. Cardiovascular System a. Physiology

- 1) Cardiac Cycle
 - a) Control of Heart Rate
 - b) Synchronicity of Pressure, Flow, ECG, Sounds, Valve Action
 - c) Impulse Propagation
 - d) Normal ECG
 - e) Electrophysiology; Ion Channels and Currents
- 2) Ventricular Function
 - a) Frank-Starling Law; Preload and Afterload, Intracardiac Pressures

- b) Force, Velocity, Length, Rate of Shortening
- c) Myocardial Contractility, Measurement Limitations
- d) Cardiac Output: Determinants and Regulation
- e) Myocardial Oxygen Utilization
- f) Systolic and Diastolic Function
- g) Cardiac Output: Fick Principle

3) Venous Return

- a) Vascular Compliance/Venous Capacitance; Controlling Factors

- b) Muscle Action; Intrathoracic Pressure; Body Position

I.C.3.a.3

- c) Blood Volume and Distribution

4) Blood Pressure

- a) Systolic, Diastolic, Mean, and Perfusion Pressures
- b) Intracardiac, Pulmonary, Venous
- c) Systemic and Pulmonary Vascular Resistance, Viscosity

- d) Baroreceptor Function

5) Microcirculation

- a) Capillary Diffusion; Osmotic Pressure, Starling's Law

- b) Pre-Post

Capillary Sphincter Control

- c) Viscosity; Rheology

- 6) Regional Blood Flow and Its Regulation a) Cerebral and Spinal Cord

- b) Coronary
- c) Pulmonary

- d) Renal

- e) Splanchnic – Hepatic f) Muscle and Skin

- g) Uterine and Placental

7) Regulation of Circulation and Blood Volume

- a) Central: Vasomotor Center, Hypothalamic-Pituitary-Adrenal Axis
 - b) Peripheral: Receptors and Reflexes
 - c) Hormonal Control
 - d) Mixed Venous Oxygen Tension and Saturation
- 8) Basics of Cardiopulmonary Resuscitation; Medications, Defibrillators, Advanced Cardiac Life Support (ACLS) Algorithms

b. Anatomy

- 1) Normal Anatomy of Heart and Major Vessels

a) Coronary Circulation

b) Heart Conduction System c. Pharmacology

- 1) Digitalis; Actions and Toxicity
- 2) Inotropes
- 3) Phosphodiesterase III Inhibitors (Inodilators): Milrinone, Others
- 4) Antiarrhythmics
- 5) Antianginal Drugs

I.C.3.c

6) Vasodilators: Nitroprusside, Nitroglycerin, Hydralazine, Nesiratide, Calcium Channel Blockers, Others

7) Angiotensin Converting Enzyme Inhibitors and Angiotensin Blockers

8) Electrolytes (Potassium, Magnesium, Phosphorus, Calcium):

Cardiovascular Effects 9) Non-Adrenergic Vasoconstrictors: Vasopressin and Congeners

4. Gastrointestinal / Hepatic Systems a. Physiology: 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

b. Enhanced Recovery After Surgery for Colorectal Surgery 5. Renal and Urinary Systems/ Electrolyte Balance

a. Physiology

1) Blood Flow, Glomerular Filtration, Tubular Reabsorption and Secretion 2)

Renal Function Tests

3) Hormonal Regulation of Extracellular Fluid

4) Hormonal Regulation of Osmolality

5) Regulation of Acid-Base Balance

6) Drug Excretion

7) Water and Electrolytes: Distribution and Balance; Compartments

8) Renin-Angiotensin-Aldosterone System

b. Pharmacology 1) Diuretics

a) Mechanism of Action

b) Comparison of Drugs

c) Effect on Electrolytes and Acid-Base Balance d) Adverse Effects

2) Dopaminergic Drugs 6. Hematologic System

a. Pharmacology

1) Anticoagulants, Antithrombotics, and Anti-Platelet Drugs

a) Mechanism of Action b) Comparison of Drugs c) Drug Interaction

I.C.6.a.1

d) Monitoring of Effects

e) Side Effects and Toxicity

f) Alternatives to Transfusion: Hemodilution, Sequestration, Autotransfusion, Blood Substitutes, Erythropoietin

2) Immunosuppressive and Anti-Rejection Drugs

b. Transfusions

1) Indications

- 2) Blood Preservation, Storage
- 3) Blood Filters and Pumps
- 4) Effects of Cooling and Heating; Blood Warmers
- 5) Blood Components, Volume Expanders
- 6) Preparation for Transfusion: Type and Cross, Type and Screen, Uncrossmatched Blood, Autologous Blood, Designated Donors
- 7) Synthetic and Recombinant Hemoglobins c. Reactions to Transfusions

- 1) Febrile
- 2) Allergic
- 3) Hemolytic: Acute and Delayed

d. Complications of Transfusions

- 1) Infections: Hepatitis, Human Immunodeficiency Virus (HIV), Cytomegalovirus (CMV), Others
- 2) Citrate Intoxication
- 3) Electrolyte and Acid Base Abnormalities
- 4) Massive Transfusion: Coagulopathies, Hypothermia
- 5) Pulmonary

a) Transfusion-Related Acute Lung Injury

b) Transfusion-Related Circulatory Overload 6) Immunosuppression

7. Endocrine and Metabolic Systems a. Physiology

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

b. Biochemistry of 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

I.C.7.b

2) Proteins

a) Functions, Hormones, Antibodies

b) Cyclic Adenosine Monophosphate (cAMP); Cyclic Guanosine

Monophosphate (cGMP) c) Lipids: Triglycerides, Lipoproteins, Cholesterol

(1) Specific Organ Metabolism (Brain, Heart, Liver, Muscle) 8.

Neuromuscular Diseases and Disorders

a. Physiology of Neuromuscular Transmission

1) Prejunctional Events: Acetylcholine Synthesis and Release, Modulation By Nicotinic and Muscarinic Prejunctional Receptors

2) Postjunctional Events: Acetylcholine Binding to Acetylcholine Receptors, Ion Flow Through Acetylcholine Receptor

b. Anatomy of the Neuromuscular Junction

1) Prejunctional Components: Motor Neurons, Neuronal Transport System, Synaptic Vesicles 2) Postjunctional Components: Muscle Cell, Acetylcholine Receptor

3) Perijunctional voltage-gated channels

D. Special Problems Or Issues in Anesthesiology

1. Physician Impairment Or Disability: Substance Abuse, Fatigue, Aging, Visual and Auditory Impairment.

2. Ethics, Practice Management, and Medicolegal Issues

a. Professionalism and Licensure

b. Ethics, Advance Directives/Do Not Resuscitate (DNR) Orders; Suspended DNR, Patient Privacy Issues.

c. Informed consent (principles, components)

- d. Patient Safety
 - 1) Medication Errors: Assessment and Prevention
 - 2) Disclosure of Errors to Patients

- e. Core Competencies

II. Advanced Topics in Anesthesiology

A. Basic Sciences

1. Physics, Monitoring, and Anesthesia Delivery Devices a. Monitoring Methods

1) Vascular Pressures: Arterial (Invasive/Noninvasive Differences), Central Venous (CVP), Pulmonary Arterial (PAP), Pulmonary Artery Occlusion (PAOP), Left Atrial (LAP), Left Ventricular End-Diastolic (LVEDP)

2) Heart Function: Heart Tones, Electrocardiogram (ECG), Echocardiography, Doppler, Cardiac Output

3) 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

4) Mixed Venous Oxygen Saturation (SvO₂)

5) Awareness Monitors

B. Instruments:

1) Cardiac Output: Fick, Dye Dilution, Thermodilution, Doppler, Impedance, Pulse Wave Analysis, Stroke Volume Assessment

2) Echocardiography: Technical Aspects, Complications

3) Coagulation Monitors

4) Ultrasound-Guided Placement of Invasive Catheters (Arterial, Central Venous) and Nerve Blocks

c. Ventilators

1) Continuous Positive Airway Pressure (CPAP) and Positive End-Expiratory Pressure (PEEP); Nasal CPAP

2) Nebulizers, Humidifiers, Drug Delivery Systems (Nitric Oxide, Others)

D. Pacemakers

1) Temporary Transvenous; Permanent (Epicardial, Endocardial), Transcutaneous

2) Types: Fixed Rate, Biventricular Synchronized, Ventricular, Atrial, Atrio-Ventricular (A-V) Sequential

3) Standard Nomenclature

4) Reasons for Failure or Malfunction e. Electrical; Fire and Explosion Hazards

1) Basic Electronics

2) Lasers, Laser Safety, Laser-Safe Endotracheal Tubes

II.A.1

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

2. Pharmacology

a. General Concepts

1) Pharmacogenetics

a) Malignant Hyperthermia (Including Diagnosis and Therapy) b) Butyrylcholinesterase (Pseudocholinesterase) Deficiency c) Prolonged Qt Syndrome

d) Genetic Factors in Drug Dose-Response Relationships

2) Addiction

a) Physiology and Pharmacology

b) Patient Addiction: Anesthetic Implications c) Addiction vs. Tolerance

B. Clinical Sciences: Anesthesia Procedures, Methods, and Techniques 1. Regional Anesthesia

a. Peripheral and Autonomic Nerve Blocks: Indications, Contraindications, Techniques, Clinical Assessment, Complications, Use of Nerve Stimulators, Use of Ultrasound

1) Head and Neck

2) Upper Extremity/Brachial Plexus 3) Trunk and Perineum

4) Lower Extremity

2. 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

C. Organ-Based Advanced Clinical Sciences 1. Central and Peripheral Nervous Systems

a. Physiology

1) Metabolism: Substrates, Aerobic and Anaerobic 2) Intracranial Pressure

a) Brain Volume, Elastance and Compliance

b) Increased ICP, Herniation 3) Electroencephalography (EEG)

a) Wave Patterns, Frequency and Amplitude, Raw and Processed, Spectral Edge

II.C.1.a.3

b) Sleep, Convulsions; O₂ and CO₂; 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

b. Anatomy

1) Regional Anesthesia; Main Nerve Blocks (Includes Techniques and Comparisons of Techniques)

a) Autonomic: Stellate, Celiac, Lumbar Sympathetic

b) Head and Neck: Retrobulbar/Peribulbar, Facial, Trigeminal Nerve and Branches, Cervical Plexus, Glossopharyngeal, Superior Laryngeal, Transtracheal, Occipital

c) 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

d) Trunk: Intercostal, Paravertebral Somatic, Ilio-Inguinal, Genito-Femoral

e) Spine: Epidural (Cervical, Thoracic, Lumbar, Caudal, Transforaminal), Spinal (Subarachnoid), Combined Spinal-Epidural, Facet

c. Pharmacology

1) CNS Drugs for Non-Anesthetic Use (Major Actions, Comparison of Drugs; Effect on Respiration; Circulation, Adverse Effects)

a) Pre- and Postanesthetic Medications (1) Opioids

(2) Opioid Antagonists, Agonist-Antagonists

b) Alpha-2 Agonists: Clonidine, Dexmedetomidine

c) Tranquilizers: Butyrophenones; Benzodiazepines

d) Anticonvulsants: Phenytoin, Carbamazepine, Gabapentin, Barbiturates, Others e) Antidepressants, Anti-Parkinson Drugs

f) Arousal Agents: Physostigmine, Benzodiazepine Antagonists

g) Antiemetics and Aspiration Prophylaxis: Phenothiazines; Butyrophenones; Metoclopramide; Anticholinergics; Serotonin

Antagonists, Antihistamines (H1 Blockers, H2 Blockers, Mixed Blockers), Antacids, Proton Pump Inhibitors

h) Substance Abuse and Addiction; Dependence

(1) Chronic Opioid Dependence and Therapy

(2) Pharmacologically-Assisted Opioid withdrawal

2) Autonomic Drugs a) Sympathetic

II.C.1.c.2.a

(1) Transmitters and Types of Receptors (2) Target Organ Effects; Metabolic Effects

(3) Agonists: Peripheral and Central Actions, Direct and Indirect Actions, Alpha vs. Beta vs. Mixed Agonists, Alpha and Beta-Receptor Subtype-Selective Agonists

(4) Antagonists: Alpha and Beta Blockers, Selective Blockers, Ganglionic Blockers

(5) Tocolytic Applications b) Parasympathetic

(1) Transmitters

(2) Muscarinic Effects

(3) Nicotinic Effects

(4) Agonists: Cholinergic and Anticholinesterases (5) Antagonists

d. Clinical Science

1) Central Nervous System

a) Seizures

b) Coma: Traumatic, Infectious, Toxic-Metabolic, Cerebrovascular Accident (CVA), Cerebral Hypoxia

(1) Glasgow Coma Scale, Management of Traumatic Brain Injury

(2) Therapeutic Barbiturate Coma

c) Drug Intoxication (CNS Drugs, Carbon Monoxide, Insecticides, Nerve Gases) d) Paraplegia, Quadriplegia, Spinal Shock, Autonomic Hyperreflexia

(1) Airway Management in the Patient with Cervical Spine Disease e) Tetanus

f) Special Problems of Anesthesia for Neurosurgery

(1) Increased Intracranial Pressure: Tumors, Hematomas, Hydrocephalus

(2) Positioning: Prone, Sitting, Other, Head Stabilization in Tongs

(3) Air Embolism

(4) Cerebral Protection from Hypoxia, Ischemia, Glucose Effects

(5) Aneurysms and A-V Malformations, Cerebral Vasospasm

(6) Interventional Neuroradiology; Coils and Embolization

(7) Pituitary Adenomas, Trans-Sphenoidal Hypophysectomy

(8) Anesthetic and Ventilatory Effects on Cerebral Blood Flow and Metabolism

(9) Fluid Management: Hypertonic Vs Isotonic Saline vs. Balanced Salt Solutions

II.C.1.d.1.f

(10) Spinal Fluid Drainage

(11) Stereotactic and Gamma-Knife Techniques, Deep Brain Stimulator Placement, Intra-Operative Wake-Up Techniques

(12) Ventriculostomy

(13) Awake Craniotomy 2. Respiratory System

a. Physiology: Lung Functions and Cellular Processes 1) Ventilation - Perfusion

a) 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

b. Anatomy 1) Lungs

- a) Divisions and Bronchoscopic Anatomy b) Bronchial and Pulmonary Circulations
- c) Microscopic Anatomy

c. Biochemistry

- 1) Normal Acid-Base Regulation: Buffer Systems; Compensatory Mechanisms; 2) Effects of Imbalance on Electrolytes and Organ Perfusion; 3) Strong Ionic Difference (SID); 4) ABG Interpretation;

a) Anion Gap;

b) Temperature Effect on Blood Gases: Alpha-Stat vs. pH-Stat d. Clinical Science

1) Respiratory System

a) Obstructive Disease

(1) Upper Airway: Congenital, Infectious, Neoplastic, Traumatic, Foreign Body, Obstructive Sleep Apnea

(2) Tracheobronchial: Congenital, Infectious, Neoplastic, Traumatic, Foreign Body

(3) Parenchymal: Asthma, Bronchitis, Emphysema, COPD, Lung Abscess, Bronchiectasis, Cystic Fibrosis, Mediastinal Masses

b) Restrictive Disease

(1) Neurologic: CNS Depression, Spinal Cord Dysfunction, Peripheral Nervous System

(2) Musculoskeletal: Muscular, Skeletal, Obesity, Chest Trauma

II.C.2.d.1.b

(3) Parenchymal: Atelectasis, Pneumonia, Interstitial Pneumonitis, Pulmonary Fibrosis, Respiratory Distress Syndrome (ARDS), Bronchopulmonary Dysplasia

(4) Pleural and Mediastinal: Pneumo-, Hemo-, and Chylothorax, Pleural Effusion, Empyema, Bronchopleural Fistula

(5) Other: Pain, Abdominal Distention

c) Management of the Patient with Respiratory Disease

(1) Evaluation: History and Physical Examination, Chest X-Ray, Arterial Blood Gases (ABGs), Pulmonary Function Tests (PFTs); Assessment of Perioperative Risk

(2) Anesthetic Management

(a) Preoperative Preparation: Respiratory Therapy, Drug Therapy (Antibiotics, Bronchodilators, Mucolytics, Steroids), Tobacco Smoking Cessation (Techniques to Assist Patients, Benefits)

(b) Intraoperative Management (1) Monitoring

(2) Choice of Anesthesia

(3) Anesthetic Techniques: Nonpulmonary Surgery, Thoracic and Pulmonary Surgery, One-Lung Ventilation, Thoracoscopic Techniques, Lung Transplantation, Mediastinoscopy

(c) Postoperative Care: Pain Management, Respiratory Therapy, Ventilator Support, Extubation Criteria

(3) Management of Respiratory Failure

(a) Nonventilatory Respiratory Management: O₂ Therapy and Toxicity, Tracheobronchial Toilet, Positive Airway Pressure, Respiratory Drugs

(b) Ventilatory Management

(1) Criteria for Ventilatory Commitment and Weaning

(2) Mode of Ventilation: Conventional Mechanical Ventilation, Peep, CPAP, IMV, SIMV, Pressure Support, Pressure Control, High Frequency Ventilation (Positive Pressure, Jet, Oscillation), Prone Ventilation, BIPAP, Airway Pressure-Release Ventilation

(3) Complications and Side Effects of Mechanical Ventilation: Volutrauma, Barotrauma, Biotrauma

(4) Management of Bronchospasm: Bronchodilator Drugs, Anti-Inflammatory Drugs, Acute and Chronic Management, Perioperative Management

(c) Other Management Adjuncts: Nitric Oxide, Steroids (d) Lung Transplantation: Anesthetic Implications

II.C

3. Cardiovascular System

a. Normal Anatomy of Heart and Major Vessels

1) Echocardiographic Heart Anatomy: Chambers, Valves, Great Vessels, Pericardium, Basic Transesophageal Echocardiography (TEE) Views

2) Radiographic: Roentgenograms, CT, MRI

3) Other

b. Clinical Sciences

1) Ischemic Heart Disease

a) Risk Factors; Predictors of Perioperative Risk, Modification of Perioperative Risk (e.g., Prophylactic Beta-Blockers)

b) Manifestations

c) Diagnosis of Myocardial Infarction and Acute Coronary Syndrome; Clinical, ECG, Enzymes, Echocardiography, Nuclear Techniques,

d) Classification of types of MI (STEMI vs. demand)

e) Pharmacological Treatment of Angina, Thoracic Epidural for Angina, Interventional Cardiology Techniques

f) Determinants of Myocardial Oxygen Requirements and Delivery, Silent Ischemia, Postoperative Ischemia

g) Perioperative Diagnosis and Treatment of Ischemia; ECG, TEE

h) Coronary Artery Bypass Procedures; Cardiopulmonary Bypass; of F-Pump Techniques

2) Valvular Heart Disease

a) Classification

b) Diagnosis (Including Echocardiography), Natural History, Surgical

Management c) Anesthetic Considerations

d) Subacute Bacterial Endocarditis Prophylaxis

3) Rhythm Disorders and Conduction Defects

a) Chronic Abnormalities: Etiology, Diagnosis, Therapy

(1) Automated Implantable Cardioverter/Defibrillator (AICD) Implantation

(2) Pacemakers: Permanent, Temporary, Transvenous, Transcutaneous; Ventricular Synchronization

(3) Ablations, Cryotherapy, Maze Procedure

b) Perioperative Dysrhythmia: Etiology, Diagnosis, Therapy

c) Perioperative Implications of Pacemaker and AICD

4) Heart Failure and Cardiomyopathy (Ischemic, Viral, Hypertrophic)

a) Definition and Functional Classification, Perioperative Diagnosis and Treatment b) Compensatory Responses

c) Right or Left Ventricular Dysfunction

II.C.3.b.4.c

- (1) Etiology
 - (2) Signs and Symptoms
 - (3) Diagnostic Tests
 - (4) Systolic vs. Diastolic Dysfunction
- d) Treatment
- (1) Pulmonary Edema
 - (2) Pulmonary Hypertension
 - (3) Cardiogenic Shock e) Cardiac Transplantation
 - 5) Cardiac Tamponade and Constrictive Pericarditis
- a) Etiology
- b) Diagnosis; TEE, PA Catheter
- c) Anesthetic Management 6) Circulatory Assist
- a) Cardiopulmonary Bypass
 - (1) Components (Pump, Oxygenator, Heat Exchanger, Filters) (2)
 - b) Cardiopulmonary Bypass Techniques
 - (3) Mechanisms of Gas Exchange
 - (4) Priming Solutions, Hemodilution
 - (5) Anticoagulation and Antagonism; Activated Clotting Time (ACT) and Other Clotting Times, Heparin Assays, Antithrombin III, Protamine Reactions, Heparin and Protamine Alternatives
 - (6) Prophylaxis with Aminocaproic Acid, Tranexamic Acid
 - (7) Anesthetic Considerations During Bypass
 - (8) Extracorporeal Membrane Oxygenation (ECMO)

(9) Cooling and Warming, Deep Hypothermic Circulatory Arrest (10) Monitoring, Blood Pressure Management

(11) Minimally Invasive Bypass Techniques

(12) Myocardial Preservation: Physiology, Techniques, Complications (13) Preconditioning

b) Minimal Invasive Cardiac Surgery

(1) Off-pump coronary artery bypass (OPCAB)

(2) Minimally invasive direct coronary artery bypass (MIDCAB)

(3) Percutaneous valve repair/replacement

c) Intraaortic Balloon: Rationale, Indications, Limitations

II.C.3.b.6

d) Ventricular Assist Devices and Artificial Heart: Internal and External 7) Pulmonary Embolism

a) Etiology: Blood, Air, Fat, Amniotic Fluid b) Diagnosis, TEE Findings

c) Treatment; Acute, Preventive

8) Hypertension

a) Etiology, Pathophysiology, Course of Disease

b) Drug Treatment, Interactions with Anesthetics, Risk of Anesthesia

c) Intra or Postoperative Hypertension; Differential Diagnosis and Treatment

9) Shock States: Anesthetic Management of Patient in Shock 10) Vascular Diseases

a) Cerebral Circulation; Luxury Perfusion, Steals, Infarcts, Intracranial Hemorrhage

b) Carotid Endarterectomy: Anesthetic Management, Monitoring of Cerebral Perfusion, Complications

c) Abdominal Aneurysm Resection: Anesthetic Management d) Peripheral Arteriosclerotic Disease

e) Aneurysms of Ascending, Descending and Arch of Aorta, Thoracoabdominal Aneurysms, Including Endovascular Repair Techniques

11) Cardiopulmonary Resuscitation a) Recognition

b) Management - Drugs, Defibrillators, Monitors, Advanced Cardiac Life Support (ACLS) Algorithms

c) Complications and Outcomes of Therapy

d) Pediatric/Adult Differences 4. Gastrointestinal / Hepatic Systems

a. Biochemistry: 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 b. Clinical Science

1) Morbid Obesity/Anesthesia for Bariatric Surgery

a) Pre-Anesthetic Evaluation and Management

b) Pharmacologic Considerations

c) Anesthetic Management (Airway, Ventilation, Monitoring, Venous Access)

d) Postoperative Management (Ventilation, Analgesia)

2) Hepatic Disease

II.C.4.b.2

a) Preoperative Laboratory Assessment

b) Anesthesia Choice (Hepatocellular Disease, Ascites, Portal Hypertension)

c) Postoperative Hepatic Dysfunction, Hepatic Failure, Hepatorenal Syndrome d) Hepatic Transplantation

3) Intestinal Obstruction

a) Causes; Paralytic Ileus; Mechanical; Vascular

b) Physiological Changes; Fluid and Electrolyte; Respiratory

c) Anesthesia Management: Full Stomach; Fluid Therapy; Nitrous Oxide

5. Renal and Urinary Systems/ Electrolyte Balance: 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

b. Urologic Surgery - Lithotripsy, Transurethral Resection of Prostate (TURP)/Irrigating Fluids/Hyponatremia

c. Perioperative Electrolyte Abnormalities 6. Hematologic System

a. Clinical Science

1) Hematologic Disorders

a) Diseases of Blood

(1) Anemias; Compensatory Mechanisms (2) Polycythemias; Primary vs. Secondary (3) Clotting Disorders

(a) Thrombocytopenia and Thrombocytopathy (b) Congenital and Acquired Factor Deficiencies

(c) Disseminated Intravascular Coagulation

(d) Fibrinolysis

(e) Pharmacologic: Anticoagulants and Antagonists (f) Coagulopathy in Trauma Patients

(4) Hemoglobinopathies, Porphyrias

b) Massive Transfusion Protocol

II.C

7. Endocrine and Metabolic Systems: Clinical Science a. Pituitary Disease

1) Hypopituitarism, Pituitary Removal - Substitution Therapy a) Panhypopituitarism

b) Diabetes Insipidus 2) Hyperpituitarism

a) Acromegaly, Including 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 Disease

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 - Hypoglycemia; Hyperglycemia and Ketoacidosis
- 3) Elective Anesthesia - Perioperative Management

II.C.7.f

- 4) Emergency Anesthesia
- 5) Hyperosmolar Coma
- 6) Pancreas Transplantation

8. Neuromuscular Diseases and Disorders: Clinical Science a. Demyelinating Diseases

1) Multiple Sclerosis

2) Motor Neuron Diseases: Amyotrophic Lateral Sclerosis, Spinobulbar Muscular Atrophy, Hereditary Spastic Paraplegia

3) Guillain-Barre Syndrome

4) Charcot-Marie-Tooth Disease b. Primary Muscle Diseases

1) Muscular Dystrophies: Duchenne's, Becker's, Limb-Girdle, Congenital, Myotonic

2) Mitochondrial Myopathies c. Channelopathies

d. Myasthenic Syndromes

1) Myasthenia Gravis

2) Lambert-Eaton Myasthenic Syndrome 3) Congenital Myasthenic Syndromes

e. Ion Channel Myotonias

- 1) Acquired Neuromyotonia
- 2) Myotonia Congenita

3) Hyperkalemic Periodic Paralysis, Paramyotonia Congenita, Postassium-
Aggravated Myotonia 4) Hypokalemic Periodic Paralysis

D. Clinical Subspecialties

1. Painful Disease States

a. Pathophysiology 1) Acute Pain

2) Cancer-Related Pain 3) Chronic Pain States

a) Acute and Chronic Neck and Low Back Pain b) Neuropathic Pain States

(1) Complex Regional Pain Syndrome, Types I and II (2) Postherpetic
Neuralgia

(3) Phantom Limb, Post-Stroke

(4) Peripheral Neuropathies (e.g., Diabetic Neuropathy)

II.D.1.a.3

c) Somatic Pain Conditions: Myofascial Pain, Facet Arthropathy, etc. b.
Treatment

1) Acute Postoperative and Posttraumatic Pain

a) Postoperative Epidural Analgesia

b) Neuraxial Opioids

c) Peripheral Nerve Blockade and Catheters d) Patient-Controlled Analgesia

e) Other Modalities, Multimodal Analgesia (Nonsteroidal Analgesics, Electrical
Stimulation, Acupuncture, Ketamine, etc.)

2) Cancer-Related Pain

a) Systemic Medications, Tolerance and Addiction b) Continuous Spinal and
Epidural Analgesia

c) Neurolytic and Non-Neurolytic Blocks

d) World Health Organization Analgesic Ladder

3) Chronic Pain (Non-Cancer-Related)

a) Systemic Medications: Nonsteroidal Anti-Inflammatory Drugs (NSAIDs),
Opioid Analgesics, Anticonvulsants, Antidepressants

b) Spinal and Epidural Analgesia

c) Peripheral Nerve Blocks

d) Sympathetic Nerve Blocks

e) Other Techniques: TENS, Spinal Cord Stimulation, Neuroablation (Surgical and Chemical Neurolysis)

2. Pediatric Anesthesia

a. Apparatus: Breathing Circuits (Advantages/Disadvantages, Dead Space, Etc.), Humidity, Thermal Control

1) Endotracheal Tube Selection (Cuffed vs. Uncuffed) and Sizing

2) Warming Devices: Types, Efficacy, Complications

b. Premedication: Drugs; Dosage; Routes; Vehicles, Including Topical Anesthetics; Parental Presence

c. Agents and Techniques

1) Induction Techniques

2) Anesthetics: Actions Different From Adults

a) Drug Toxicities Preferentially Occurring in Children: e.g., Propofol b) Opioid Dosing and Sensitivity

c) Neuromuscular Blockers (Sensitivity, Congenital Diseases, Complications of Succinylcholine, Age-Related and Drug-Related Pharmacodynamics and Pharmacokinetics)

II.D.2.c.2

d) Regional Anesthesia

d. Fluid Therapy and Blood Replacement, Physiologic Anemia, Glucose Requirements

e. Problems in Intubation and Extubation (Full Stomach, Diaphragmatic Hernia, Tracheo Esophageal (T-E) Fistula, Pierre-Robin, Treacher-Collins, Crouzon's, Goldenhar's, Hurler's, Awake/Fiberoptic Intubation, Dentition, Laryngospasm, Stridor)

f. Neonatal Physiology 1) Respiratory

a) Development, Anatomy, Surfactant b) Pulmonary Oxygen Toxicity

c) Pulmonary Function

d) Lung Volumes vs. Adult

e) Airway Differences, Infant vs. Adult 2) Cardiovascular

a) Transition, Fetal to Adult

b) Persistent Fetal Circulation

3) Retinopathy of Prematurity: Anesthetic Implications

4) Metabolism, Fluid Distribution and Renal Function

5) Thermal Regulation (Neutral Temperature, Nonshivering Thermogenesis)

6) Fetal Hemoglobin

7) Prematurity, Apnea of Prematurity

8) Bronchopulmonary Dysplasia

g. Congenital Heart and Major Vascular Disease 1) Cyanotic Defects

2) Acyanotic Defects

3) Primary Pulmonary Hypertension

4) Major Vascular Malformations: Coarctation, Persistent Patent Ductus Arteriosus, Vascular Rings.

5) Altered Uptake/Distribution of IV and Inhalation Anesthetics 6) Anesthetic Considerations

a) Cardiac Surgery; Corrective and Palliative

b) Noncardiac Surgery

c) Chronic Congenital Heart Disease, Corrected, Uncorrected, and Palliated

(1) In Childhood Beyond the Newborn and Infant Periods

(2) In Adulthood h. Emergencies in the Newborn

1) Diaphragmatic Hernia

II.D.2.h

2) Tracheoesophageal Fistula and Esophageal Atresia 3) Neonatal Lobar Emphysema

4) Pyloric Stenosis

5) Necrotizing Enterocolitis

6) Omphalocele/Gastroschisis

7) Respiratory Distress Syndrome: Etiology, Management, Ventilation Techniques 8) Myelomeningocele

i. Pediatric Medical Problems with Anesthetic Implications

1) Respiratory: Upper Respiratory Infections (Colds, Epiglottitis, Laryngotracheobronchitis), Bronchopulmonary Dysplasia, Cystic Fibrosis

2) Musculoskeletal: Muscular Dystrophies, Myotonias, Etc.

3) Developmental Delay, Cerebral Palsy, Autism

4) Childhood Obesity

5) Endocrine Diseases: Childhood Diabetes, Congenital Adrenal Hyperplasia, Etc.

6) Skeletal Abnormalities with Or without Systemic Implications: Klippel-Feil, Achondroplasia, Marfan's, Morquio's, Osteogenesis Imperfect

7) Trisomy 21 and Other Chromosomal Abnormalities

8) Juvenile Rheumatoid Arthritis

9) Anemias: Congenital and Acquired: Iron Deficiency, Physiologic Anemia, Sickle Cell, Thalassemia, Etc.

10) Malignant Hyperthermia in Children; Susceptibility, Associated Diseases, Anesthetic Management of MH Susceptibility, Intraoperative Diagnosis, Treatment

j. Anesthetic Implications for Common Non-Neonatal Pediatric Subspecialty Surgery

1) Otolaryngology: Cleft Lip and Palate, Tonsillectomy and Adenoidectomy, Common Ear Procedures, Peritonsillar Abscess, Flexible and Rigid Bronchoscopy, Diagnostic and Therapeutic Laryngoscopy Techniques (Jet Ventilation, Laser Implications), Airway Foreign Bodies

2) Neurosurgery: Craniotomies for Tumor Or Vascular Malformations, Hydrocephalus, Ventriculoperitoneal Shunts, Craniofacial Procedures, Tethered Spinal Cord, Halo Placement Implications

3) Thoracic Surgery: Anterior Mediastinal Mass, Lung Isolation Techniques, Pectus Excavatum and Carinatum

4) General and Urologic Surgery: Laparotomy vs Laparoscopy, Bowel Surgery, Urologic Surgery (Wilms Tumor, Ureteral Reimplantation, Bladder and Urethral Malformations, Neuroblastoma)

5) Orthopedic Surgery: Fractures and Dislocations, Congenital Hip Dysplasia, Foot and Hand Malformations; Scoliosis Implications and Repair

6) Ophthalmologic: Strabismus, Cataract, Glaucoma Procedures, Etc.

II.D.2

k. Outpatient Pediatric Anesthesia

1) Indications and Contraindications

2) Anesthetic Considerations: Premedication, Induction, Maintenance, Monitoring

3) Postoperative Considerations: Recovery Period, Discharge Criteria, Post-Discharge Monitoring/Follow-Up

l. Postoperative Analgesia

1) Systemic Medications and Routes of Administration, Multimodal Therapy

2) Regional Techniques: Caudal, Epidural, Nerve Blocks

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

n. Pediatric Sedation: Guidelines, Pharmacology, Credentialing, Indications, Monitoring, Complications

o. Pediatric Anesthesia Outside the Operating Rooms: Diagnostic and Interventional Radiologic Procedures, Gastroenterology Laboratory, MRIs, Radiation Therapy

3. Obstetric Anesthesia

a. Maternal Physiology

1) Effects of Pregnancy on Uptake and Distribution

2) Respiratory (Anatomy, Lung Volumes and Capacities, Oxygen Consumption, Ventilation, Blood Gases, Acid Base)

3) Cardiovascular (Aorto-Caval Compression, Regulation of Uterine Blood Flow)

4) Renal

5) Liver (Albumin/Globulin Ratio, Protein Binding of Drugs)

6) Gastrointestinal (Gastric Acid, Motility, Anatomic Position, Gastroesophageal Sphincter Function)

7) Hematology (Blood Volume, Plasma Proteins, Coagulation) 8) Placenta

a) Placental Exchange - O₂, CO₂ b) Placental Blood Flow

c) Barrier Function

b. Maternal-Fetal Considerations 1) Pharmacology

a) Anesthetic Drugs and Adjuvants

b) Oxytocic Drugs (Indications, Adverse Effects)

c) Tocolytic Drugs (Indications, Adverse Effects)

d) Antiseizure Drugs; Interactions (Magnesium Sulfate)

e) Mechanisms of Placental Transfer, Placental Transfer of Specific Drugs f)

Fetal Disposition of Drugs

II.D.3.b.1

g) Drug Effects on Newborn

2) Amniotic Fluid (Amniocentesis, Oligohydramnios, Polyhydramnios)

3) Antepartum Fetal Assessment and Therapy (Ultrasonography, FHR Monitoring, Nonstress Test, Stress Test, Biophysical Profile)

4) Anesthetic Techniques and Risks (Elective vs. Emergency, General vs. Regional) a) Systemic Medications: Opioids, Sedatives, Inhalational Agents
b) Regional Techniques

(1) Epidural, Caudal, Spinal, Combined Spinal/Epidural

(2) Paracervical Block, Lumbar Sympathetic Block, Pudendal Block c) Complications (Aspiration, Nerve Palsies)

5) Physiology of Labor (Metabolism, Respiration, Cardiovascular, Thermoregulation)

6) Influence of Anesthetic Technique on Labor

7) Cesarean Delivery: Indications, Urgent/Emergent, Anesthetic Techniques and Complications, Difficult Airway, Aspiration Prophylaxis

c. Pathophysiology of Complicated Pregnancy 1) Problems During Pregnancy and Delivery

a) Anesthesia for Cesarean or Non-Obstetric Surgery

b) Ectopic Pregnancy

c) Spontaneous Abortion

d) Gestational Trophoblastic Disease (Hydatid Mole)

e) Autoimmune Disorders (Lupus, Antiphospholipid Syndrome) f) Endocrine (Thyroid, Diabetes, Pheochromocytoma)

g) Heart Disease (Valvular Disorders, Pulmonary Hypertension, Congenital Heart Disease, Arrhythmias, Cardiomyopathy)

h) Hematologic (Sickle Cell Anemia, Idiopathic Thrombocytopenic Purpura, Von Willebrand Disease, Disseminated Intravascular Coagulation (DIC), Anticoagulant Therapy, Rh and ABO Incompatibility)

i) Hypertension (Chronic, Pregnancy-Induced)

j) Neurologic (Seizures, Myasthenia, Spinal Cord Injury, Multiple Sclerosis, Subarachnoid Hemorrhage)

k) Respiratory (Asthma, Respiratory Failure) l) Renal

m) Human Immunodeficiency Virus Infection

2) Problems of Term and Delivery

a) Intrapartum Fetal Assessment (Fetal Heart Rate Monitoring, Fetal Scalp Blood Gases, Fetal Pulse Oximetry)

b) Preeclampsia and Eclampsia

II.D.3.c.2

c) Supine Hypotensive Syndrome

d) Aspiration of Gastric Contents

e) Embolic Disorders (Amniotic Fluid Embolism, Pulmonary Thromboembolism) f) Antepartum Hemorrhage (Placenta Previa, Abruptio Placenta, Uterine Rupture) g) Postpartum Hemorrhage (Uterine Atony, Placenta Accreta)

h) Cord Prolapse

i) Retained Placenta

j) Dystocia, Malposition, and Malpresentation (Breech, Transverse Lie)

k) Maternal Cardiopulmonary Resuscitation

l) Fever and Infection

m) Preterm Labor

n) Vaginal Birth After Cesarean Section (VBAC)

o) Multiple Gestation

- 3) Resuscitation of Newborn
 - a) Apgar Scoring
 - b) Umbilical Cord Blood Gas Measurements
 - c) Techniques and Pharmacology of Resuscitation
 - d) Intrauterine Surgery (Maternal and Fetal Considerations, Intrauterine Fetal Resuscitation)
4. Otorhinolaryngology (ENT) Anesthesia: Airway Endoscopy; Microlaryngeal Surgery; Laser Surgery, Hazards, Complications (Airway Fires, Etc.)
5. Anesthesia for Plastic Surgery, Liposuction
6. Anesthesia for Laparoscopic Surgery; Cholecystectomy; Gynecologic Surgery; Gastric Stapling; Hiatus Hernia Repair; Anesthetic Management; Complications
7. Ophthalmologic Anesthesia, Retrobulbar and Peribulbar Blocks; Open Eye Injuries
8. Orthopedic Anesthesia; Tourniquet Management, Complications, Regional Vs. General Anesthesia
9. Trauma Anesthesia
 - a. Massive Trauma
 - 1) Evaluation of the Trauma Patient
 - 2) Hemorrhagic Shock
 - b. Burn Management
 - c. Mass Casualty
 - 1) Crisis Management and Teamwork
 - d. Biological Warfare

II.D

10. Anesthesia for Ambulatory Surgery
 - a. Patient Selection and Preoperative Management
 - b. Anesthetic Management
 - c. Discharge Criteria and Postoperative Follow-Up, Including Continuous Nerve Blocks
 - d. Office-Based Anesthesia: Equipment, Safety, Organization, Patient Management

11. Geriatric Anesthesia / Aging
 - a. Pharmacological Implications, MAC Changes
 - b. Physiological Implications: CNS, Circulatory, Respiratory, Renal, Hepatic

12. Critical Care
 - a. Shock States
 - 1) Etiology, Classification, Pathophysiology
 - 2) Septic Shock and Life-Threatening Infection
 - 3) Systemic Inflammatory Response Syndrome
 - 4) Multiple Organ Dysfunction Syndrome
 - b. Poisoning and Drug Overdose
 - c. Near-Drowning
 - d. Infection Control
 - 1) General and Universal Precautions
 - 2) Needle Stick Injury
 - 3) Catheter Sepsis
 - 4) Nosocomial Infections
 - 5) Antibiotics: Antibacterial, Antifungal, Antiviral, Antiparasitic; Antimicrobial Resistance
 - e. Ventilator Management
 - 1) Volume Controlled; Pressure Controlled; PEEP, Inspired Oxygen Concentration; Tidal Volume
 - 2) Pressure Support; Weaning

E. Special Problems or Issues in Anesthesiology

1. Electroconvulsive Therapy
2. Organ Donors: Pathophysiology and Clinical Management
3. Radiologic Procedures; CT Scan; MRI-Anesthetic Implications/Management, Anesthesia in Locations Outside the Operating Rooms
4. Ethics, Practice Management, and Medicolegal Issues
 - a. Professionalism and Credentialing, Licensure

b. Ethics, Advance Directives/Do Not Resuscitate (DNR) Orders; Patient Privacy Issues

II.E.4

c. Malpractice: Definition, Legal Actions and Consequences, National Practitioner Database, Closed Claims Findings, Anesthetic Accidents, Professional Liability Insurance

d. Practice Management; Medicare/Medicaid Requirements

e. Primary Certification, Recertification, Maintenance of Certification and Related Issues (Professional Standing, Lifelong Learning, Cognitive Knowledge, Clinical Practice Assessment, Systems-Based Practice)

f. Costs of Medical/Anesthesia Care, Operating Room Management g. Patient Safety

1) Definitions: Medical Error, Adverse Event, Sentinel Event

2) Medication Errors: Assessment and Prevention

3) Reporting: Mandatory and Voluntary Systems, Legal Requirements 4) Disclosure of Errors to Patients

5) Safety Practices: Process-Based, Evidence-Based

6) Root Cause Analysis

h. Quality Improvement

1) Quality Improvement Basics: Design, Analysis, Implementation of Quality Improvement Project

a) Anesthesia Quality Institute; Data Entry; Information

b) Lean Six Sigma; Assessing QI Methods; Approach

c) Physician Quality Reporting System: Significance and Role in Practice d) Barriers to Quality Improvement

Thesis Component

(Fifth year of MS Anaesthesiology Programme)

RESEARCH/ THESIS WRITING

Total of one year will be allocated for work on a research project with thesis writing. Project must be completed and thesis be submitted before the end of training. Research can be done as one block in 5th year of training or it can be stretched over five years of training in the form of regular periodic rotations during the course as long as total research time is equivalent to one calendar year.

Research Experience

The active research component program must ensure meaningful, supervised research experience with appropriate protected time for each resident while maintaining the essential clinical experience. Recent productivity by the program faculty and by the residents will be required, including publications in peer-reviewed journals. Residents must learn the design and interpretation of research studies, responsible use of informed consent, and research methodology and interpretation of data. The program must provide instruction in the critical assessment of new therapies and of the surgical literature. Residents should be advised and supervised by qualified staff members in the conduct of research.

Clinical Research

Each resident will participate in at least one clinical research study to become familiar with:

1. Research design
2. Research involving human subjects including informed consent and operations of the Institutional Review Board and ethics of human experimentation
3. Data collection and data analysis
4. Research ethics and honesty
5. Peer review process

This usually is done during the consultation and outpatient clinic rotations.

Case Studies or Literature Reviews

Each resident will write, and submit for publication in a peer-reviewed journal, a case study or literature review on a topic of his/her choice.

Laboratory Research

Bench Research

Participation in laboratory research is at the option of the resident and may be arranged through any faculty member of the Division. When appropriate, the research may be done at other institutions.

Research involving animals

Each resident participating in research involving animals is required to:

1. Become familiar with the pertinent Rules and Regulations of the University of Health Sciences Lahore i.e. those relating to "Health and Medical Surveillance Program for Laboratory Animal Care Personnel" and "Care and Use of Vertebrate Animals as Subjects in Research and Teaching"
2. Read the "Guide for the Care and Use of Laboratory Animals"
3. View the videotape of the symposium on Humane Animal Care

Research involving Radioactivity

Each resident participating in research involving radioactive materials is required to

1. Attend a Radiation Review session
2. Work with an Authorized User and receive appropriate instruction from him/her.

METHODS OF INSTRUCTION/COURSE CONDUCTION

As a policy, active participation of students at all levels will be encouraged. Following teaching modalities will be employed:

1. Lectures
2. Seminar Presentation and Journal Club Presentations
3. Group Discussions
4. Grand Rounds
5. Clinico-pathological Conferences
6. SEQ as assignments on the content areas
7. Skill teaching in ICU, Operation theatres, emergency and ward settings
8. Attend genetic clinics and rounds for at least one month.
9. Self study, assignments and use of internet
10. Bedside teaching rounds in ward

11. OPD & Follow up clinics
12. Long and short case presentations

In addition to the conventional teaching methodologies interactive strategies like conferences will also be introduced to improve both communication and clinical skills in the upcoming consultants. Conferences must be conducted regularly as scheduled and attended by all available faculty and residents. Residents must actively request autopsies and participate in formal review of gross and microscopic pathological material from patients who have been under their care. It is essential that residents participate in planning and in conducting conferences.

1. Clinical Case Conference

Each resident will be responsible for at least one clinical case conference each month. The cases discussed may be those seen on either the consultation or clinic service or during rotations in specialty areas. The resident, with the advice of the Attending Surgeon on the Consultation Service, will prepare and present the case(s) and review the relevant literature.

2. Monthly Student Meetings

Each affiliated medical college approved to conduct training for MS Anaesthesiology will provide a room for student meetings/discussions such as:

- a. Journal Club Meeting
- b. Core Curriculum Meetings
- c. Skill Development

a. Journal Club Meeting

A resident will be assigned to present, in depth, a research article or topic of his/her choice of actual or potential broad interest and/or application. Two hours per month should be allocated to discussion of any current articles or topics introduced by any participant. Faculty or outside researchers will be

invited to present outlines or results of current research activities. The article should be critically evaluated and its applicable results should be highlighted, which can be incorporated in clinical practice. Record of all such articles should be maintained in the relevant department.

b. *Core Curriculum Meetings*

All the core topics of Anaesthesiology should be thoroughly discussed during these sessions. The duration of each session should be at least two hours once a month. It should be chaired by the chief resident (elected by the residents of the relevant discipline). Each resident should be given an opportunity to brainstorm all topics included in the course and to generate new ideas regarding the improvement of the course structure

c. *Skill Development*

Two hours twice a month should be assigned for learning and practicing clinical skills.

List of skills to be learnt during these sessions is as follows:

1. Residents must develop a comprehensive understanding of the indications, contraindications, limitations, complications, techniques, and interpretation of results of those technical procedures integral to the discipline
2. Residents must acquire knowledge of and skill in educating patients about the technique, rationale and ramifications of procedures and in obtaining procedure-specific informed consent. Faculty supervision of residents in their performance is required, and each resident's experience in such procedures must be documented by the program director.
3. Residents must have instruction in the evaluation of medical literature, clinical epidemiology, clinical study design, relative and absolute risks of disease, medical statistics and medical decision-making.
4. Training must include cultural, social, family, behavioral and economic issues, such as confidentiality of information, indications for life support systems, and allocation of limited resources.
5. Residents must be taught the social and economic impact of their decisions on patients, the primary care physician and society. This can be achieved by attending the bioethics lectures

6. Residents should have instruction and experience with patient counseling skills and community education.
7. This training should emphasize effective communication techniques for diverse populations, as well as organizational resources useful for patient and community education.
8. Residents should have experience in the performance of Anaesthesiology related clinical laboratory and radionuclide studies and basic laboratory techniques, including quality control, quality assurance and proficiency standards
9. Each resident will manage at least the following essential Anaesthesiological cases and observe and participate in each of the following procedures, preferably done on patients under supervision initially and then independently.

3. Annual Grand Meeting

Once a year all residents enrolled for MS Anaesthesiology should be invited to the annual meeting at UHS Lahore.

One full day will be allocated to this event. All the chief residents from affiliated institutes will present their annual reports. Issues and concerns related to their relevant courses will be discussed. Feedback should be collected and suggestions should be sought in order to involve residents in decision making.

The research work done by residents and their literary work may be displayed.

In the evening an informal gathering and dinner can be arranged. This will help in creating a sense of belonging and ownership among students and the faculty.

LOG BOOK

Would be part of Portfolio

The residents must maintain a log book and get it signed regularly by the supervisor. A complete and duly certified log book should be part of the requirement to sit for MS examination. Log book should include adequate number of diagnostic and therapeutic procedures observed and performed, the indications for the procedure, any complications and the interpretation of the results, routine and emergency management of patients, case presentations in CPCs, journal club meetings and literature review.

Proposed Format of Log Book is as follows:

Candidate's Name: _____

Roll No. _____

The above mentioned procedures shall be entered in the log book as per format:

Procedures Performed

Sr.#	Date	Name of Patient, Age, Sex & Admission No.	Diagnosis	Procedure Performed	Supervisor's Signature
1					
2					
3					
4					

Emergencies Handled

Sr.#	Date	Name of Patient, Age, Sex & Admission No.	Diagnosis	Procedure/Management	Supervisor's Signature
1					
2					
3					
4					

Case Presented

Sr.#	Date	Name of Patient, Age, Sex & Admission No.	Case Presented	Supervisor's Signature
1				
2				
3				
4				

Seminar/Journal Club Presentation

Sr. #	Date	Topic	Supervisor's signature
1			
2			
3			
4			

Evaluation Record

(Excellent, Good, Adequate, Inadequate, Poor)

At the end of the rotation, each faculty member will provide an evaluation of the clinical performance of the fellow.

Sr. #	Date	Method of Evaluation (Oral, Practical, Theory)	Rating	Supervisor's Signature
1				
2				
3				
4				

EVALUATION & ASSESSMENT STRATEGIES

Assessment

It will consist of action and professional growth oriented ***student-centered integrated assessment*** with an additional component of ***informal internal assessment, formative assessment*** and measurement-based ***summative assessment***.

Student-Centered Integrated Assessment

It views students as decision-makers in need of information about their own performance. Integrated Assessment is meant to give students responsibility for deciding what to evaluate, as well as how to evaluate it, encourages students to '**own**' the evaluation and to use it as a basis for self-improvement. Therefore, it tends to be growth-oriented, student-controlled, collaborative, dynamic, contextualized, informal, flexible and action-oriented.

In the proposed curriculum, it will be based on:

- Self Assessment by the student
- Peer Assessment
- Informal Internal Assessment by the Faculty

Self Assessment by the Student

Each student will be provided with a pre-designed self-assessment form to evaluate his/her level of comfort and competency in dealing with different relevant clinical situations. It will be the responsibility of the student to correctly identify his/her areas of weakness and to take appropriate measures to address those weaknesses.

Peer Assessment

The students will also be expected to evaluate their peers after the monthly small group meeting. These should be followed by a constructive feedback according to the prescribed guidelines and should be non-judgmental in nature. This will enable students to become good mentors in future.

Informal Internal Assessment by the Faculty

There will be no formal allocation of marks for the component of Internal Assessment so that students are willing to confront their weaknesses rather than hiding them from their instructors.

It will include:

- a. Punctuality
- b. Ward work
- c. Monthly assessment (written tests to indicate particular areas of weaknesses)
- d. Participation in interactive sessions

Formative Assessment

Will help to improve the existing instructional methods and the curriculum in use

Feedback to the faculty by the students:

After every three months students will be providing a written feedback regarding their course components and teaching methods. This will help to identify strengths and weaknesses of the relevant course, faculty members and to ascertain areas for further improvement.

Summative Assessment

It will be carried out at the end of the programme to empirically evaluate cognitive, psychomotor and affective domains in order to award diplomas for successful completion of courses.

Intermediate Examination
MS Anaesthesiology
Total Marks: 500

All candidates admitted in MS Anaesthesiology course shall appear in Intermediate examination at the end of second calendar year.

There shall be one written paper of 300 marks, clinical, TOACS/OSCE & ORAL of 200 marks.

Topics included in paper:

Basic Principles of General Surgery related to Anaesthesiology.

Basic Principals of Internal Medicine related to Anaesthesiology.

Written Component = 300 Marks
Clinical, TOACS/OSCE & ORAL = 200 Marks

Total = 500 Marks

Written Paper:

MCQs = 100 Marks
SEQ = 10 Marks

Total = 300 Marks

Clinical, TOACS/OSCE & ORAL

4 Short Cases = 100 Marks
1 Long Case = 50 Marks
TOACS/OSCE & ORAL = 50 Marks

Total = 200 Marks

Final MS Anaesthesiology
Total Marks: 1500

All candidates admitted in MS Anaesthesiology course shall appear in Final examination at the end of structured training programme (end of 5th calendar year) and after clearing Intermediate examinations.

There shall be two written papers of 250 marks each, clinical, TOACS/OSCE & ORAL of 500 marks, C.I.S assessment of 100 marks and thesis examination of 400 marks.

Final MS Anaesthesiology
Clinical Examination
Total Marks: 1000

Topics included in paper 1

- | | |
|--|-----------|
| 1. Preoperative assessment and preparation | (25 MCQs) |
| 2. General anaesthesia: methods and techniques | (25 MCQs) |
| 3. Local and regional anaesthesia | (25 MCQs) |
| 4. Anaesthesia for special situations | (25 MCQs) |

Topics included in paper 2

- | | |
|--|-----------|
| 1. Pre-hospital and emergency medicine | (20 MCQs) |
| 2. Postoperative care | (20 MCQs) |
| 3. Intensive care medicine | (20 MCQs) |
| 4. Technical equipment and monitoring | (20 MCQs) |
| 5. Pain management | (20 MCQs) |

Components of Final Clinical Examination

Theory

Paper I	<u>250 Marks</u>	3 Hours
5 SEQs (10 marks each)	50 Marks	
100 MCQs (2 marks each)	200 Marks	
Paper II	<u>250 Marks</u>	3 Hours
5 SEQs (10 marks each)	50 Marks	
100 MCQs (2 marks each)	200 Marks	

The candidates who pass in theory papers, will be eligible to appear in the clinical and oral Examination

<u>Clinical, TOACS/OSCE & ORAL</u>	500 Marks
Four short cases	200 Marks
One long case:	100 Marks
TOACS/OSCE & ORAL	200 Marks
<u>Continuous Internal Assessment</u>	<u>100 Marks</u>

Final MS Anaesthesiology
Thesis Examination
Total Marks: 400

All candidates admitted in MS Anaesthesiology course shall appear in thesis examination at the end of 5th year of the MS programme. The examination shall include thesis evaluation with defense.

RECOMMENDED BOOKS

1. Aithenhead A. R., Smith G., Rowbotham D. J. ***Textbook of Anaesthesia***. 5th ed. Churchill Livingstone
2. Morgan G. E., Mikail M. S., Murray M. J. ***Clinical Anaesthesiology***. 4th ed. Lange
3. Yao and Artusio's. ***Anaesthesiology:Problem oriented Patient Management*** 5th ed. Lippincott Williams and Wilking
4. David P. D. and Kenny G. N. C. ***Basic Physics and Measurement in Anaesthesia***. 5th ed. Butterworth Heinmann
5. Fathalla M. F. and Fathalla M. M. F. ***A Practical Guide for Health Researcher***. Cairo: World Health Organization; 2004.

RECOMMENDED JOURNALS

1. British Journal of Anaesthesiology
2. Anaesthesia (British Journal)
3. Anaesthesia and Analgesia (American Journal)
4. Anaesthesia and Critical Care (British Journal)

APPENDIX "E"
(See Regulation 9-iii)

MANDATORY WORKSHOPS

1. Each candidate of MD/MS/MDS program would attend the 04 mandatory workshops and any other workshop as required by the university.
2. The four mandatory workshops will include the following

d. Synopsis Writing

c. Communication Skills

d. Introduction to Computer / Information Technology and Software programs

1. The workshops will be held on 03 monthly basis.
4. An appropriate fee for each workshop will be charged.
5. Each workshop will be of 02 - 05 days duration.
6. Certificates of attendance will be issued upon satisfactory completion of workshops.

APPENDIX "F"
(See Regulation 9xxiii, 13, 14 & 16)

CONTINUOUS INTERNAL ASSESSMENTS

a) **Workplace Based Assessments**

Workplace based assessments will consist of Generic as well as Specialty Specific Competency Assessments and Multisource Feedback Evaluation.

Generic Competency Training & Assessments

The Candidates of all MD / MS / MDS programs will be trained and assessed in the following five generic competencies.

i. **Patient Care.**

- a. Patient care competency will include skills of history taking, examination, diagnosis, plan of investigation, clinical judgment, plan of treatment, consent, counseling, plan of follow up, communication with patient / relatives and staff.
- b. The candidate shall learn patient care through ward teaching, departmental conferences, morbidity and mortality meetings, core curriculum lectures and training in procedures and operations.
- c. The candidate will be assessed by the supervisor during presentation of cases on clinical ward rounds, scenario based discussions on patient management, multisource feedback evaluation, Direct Observation of Procedures (DOPS) and operating room assessments.
- d. These methods of assessments will have equal weightage.

ii. **Medical Knowledge and Research**

- a. The candidate will learn basic factual knowledge of illnesses relevant to the specialty through lectures/discussions on topics selected from the syllabus, small group tutorials and bed side rounds.
- b. The medical knowledge/skill will be assessed by the teacher during case based discussions and presentations to the supervisor.
- c. The candidate will be trained in designing research project, data collection, data analysis and presentation of results by the supervisor.

- d. The acquisition of research skill will be assessed as per regulations governing thesis evaluation and its acceptance.

iii. **Practice and System Based Learning**

- a. This competency will be learnt from journal clubs, review of literature, policies and guidelines, audit projects, medical error investigation, root cause analysis and awareness of healthcare facilities.
- b. The assessment methods will include case studies, presentation in morbidity and mortality review meetings and presentation of audit projects if any.
- c. These methods of assessment shall have equal weight-age.

iv. **Communication Skills**

- a. These will be learnt from role models, supervisor and workshops.
- b. They will be assessed by direct observation of the candidate whilst interacting with the patients, relatives, colleagues and with multisource feedback evaluation.

v. **Professionalism as per Hippocratic Oath**

- a. This competency is learnt from supervisor acting as a role model, ethical case conferences and lectures on ethical issues such as confidentiality, informed consent, end of life decisions, conflict of interest, harassment and use of human subjects in research.
- b. The assessment of residents will be through multisource feedback evaluation according to proformas of evaluation and its' scoring method.

Specialty Specific Competencies

- i. The candidates will be trained in operative and procedural skills according to a quarterly based schedule.
- ii. The level of procedural competency will be according to a competency table to be developed by each specialty.

iii. The following key will be used for assessing operative and procedural competencies:

a. **Level 1 Observer status**

The candidate physically present and observing the supervisor and senior colleagues

b. **Level 2 Assistant status**

The candidate assisting procedures and operations

c. **Level 3 Performed under supervision**

The candidate operating or performing a procedure under direct supervision

d. **Level 4 Performed independently**

The candidate operating or performing a procedure without any supervision

iv. **Procedure Based Assessments (PBA)**

a. Procedural competency will assess the skill of consent taking, preoperative preparation and planning, intraoperative general and specific tasks and postoperative management

b. Procedure Based assessments will be carried out during teaching and training of each procedure.

c. The assessors may be supervisors, consultant colleagues and senior residents.

d. The standardized forms will be filled in by the assessor after direct observation.

e. The resident's evaluation will be graded as satisfactory, deficient requiring further training and not assessed at all.

f. Assessment report will be sub

g. A satisfactory score will be required to be eligible for taking final examination.

Multisource Feedback Evaluation

- i. The supervisor would ensure a multisource feedback to collect peer assessments in medical knowledge, clinical skills, communication skills, professionalism, integrity, and responsibility.
- ii. Satisfactory annual reports will be required to become eligible for the final examination

b) Completion Of Candidate's Training Portfolio

- i. The Candidate's Training Portfolio (CTP) will be published (or computer based portfolio downloadable) by the university.
- ii. The candidates would either purchase the CTP or download it from the KEMU web site.
- iii. The portfolio will consist of the following components
 - a) Enrollment details.
 - b) Candidate's credentials as submitted on the application for admission form.
 - c) Timeline of scheduled activities e.g dates of commencement and completion of training, submission of synopsis and thesis, assessments and examination dates etc (**Appendix H**)
 - d) Log Book of case presentations, operations and procedures recorded in an appropriate format and validated by the supervisor.
 - e) Record of participation and presentations in academic activities e.g lectures, workshops, journal clubs, clinical audit projects, morbidity & mortality review meetings, presentation in house as well as national and international meetings.
 - f) Record of Publications if any.
 - g) Record of results of assessments and examinations if any
 - h) Synopsis submission proforma and IRB proforma and AS&RB approval Letter
 - i) Copy of Synopsis as approved by AS&RB
- iv. Candidates Training Portfolio shall be assessed as per proforma given in "**Appendix-G**".

Supervisor's Annual Review Report.

This report will consist of the following components:-

- i. Verification and validation of Log Book of operations & procedures according to the expected number of operations and procedures performed (as per levels of competence) determined by relevant board of studies.
- ii. A 90 % attendance in academic activities is expected. The academic activities will include: Lectures, Workshops other than mandatory workshops, Journal Clubs, Morbidity & Mortality Review Meetings and Other presentations.
- iii. Assessment report of presentations and lectures
- iv. Compliance Report to meet timeline for completion of research project.
- v. Compliance Report on Personal Development Plan.
- vi. Multisource Feedback Report, on relationship with colleagues, patients.
- vii. Supervisor will produce an annual report based on assessments as per proforma in appendix-G and submit it to the Examination Department.
- viii. 75 % score will be required to pass the Continuous Internal Assessment on annual review.

APPENDIX " G "

(See Regulation 9ix, 9xxiii-d, 10, 11, 14 & 16)

Supervisor's Evaluation

PROFORMA FOR CONTINUOUS INTERNAL ASSESSMENTS

1. Generic Competencies			
(Please score from 1 – 100. 75% shall be the pass marks)		Component Score	Score achieved
i.	Patient Care	20	
ii.	Medical Knowledge and Research	20	
iii.	Practice and System Based Learning		
	• Journal Clubs	04	
	• Audit Projects	04	
	• Medical Error Investigation and Root Cause Analysis	04	
	• Morbidity / Mortality / Review meetings	04	
iv.	Communication Skills		
	• Informed Consent	10	
	• End of life decisions	10	
v.	Professionalism		
	• Punctuality and time keeping	04	
	• Patient doctor relationship	04	
	• Relationship with colleagues	04	
	• Awareness of ethical issues	04	
	• Honesty and integrity	04	
2. Specialty specific competencies			
Please score from 1 – 100. 75% shall be the pass marks			Score achieved
Operative Skills / Procedural Skills			
3. Multisource Feedback Evaluation (Please score from 1 – 100. 75% shall be the pass marks)			
4. Candidates Training Portfolio (Please score from 1 – 100.75% shall be the pass marks)			
(Please score from 1 – 100. 75% shall be the pass marks)		Component Score	Score achieved
i.	Log book of operations and procedures	25	
ii.	Record of participation and presentation in academic activities	25	
iii.	Record of publications	25	
iv.	Record of results of assessments and examinations	25	