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Saudi Commission for Health Specialties

Cardiac Anesthesia Fellowship Curriculum2020


بسم الله الرحمن الرحيم

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CARDIAC ANESTHESIA CURRICULUM

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FOREWARD

Cardiac anesthesia is a highly demanding specialty with inclusion of high-risk patients, complicated surgical or catheter-related procedures, and an urge for patients to be discharged home as early as possible. Our objective is to equip the fellows to function and cooperate with a team of specialists in multiple health care environments.

The program is patient-centered, focused on decision making, and evidence-based, and strives to adhere to the highest levels of scientific and ethical standards so as to provide high-quality care to the community. The time in which we are living is a period of transformation. The population is increasing and becoming increasingly diverse. Even the less commonly seen cardiac anomalies are now frequently encountered because of improved diagnostic modalities. The program aims to produce a globally competitive cardiac anesthesiologist who can work at an advanced level of care to provide patients with the best possible multidisciplinary treatment.

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1. CURRICULUM CRITERIA

1. Introduction

Cardiovascular diseases are the leading cause of death all over the world, and Saudi Arabia is no exception. According to a report by the World Health Organization (WHO) published in 2018, cardiovascular diseases accounted for 37% of the deaths in the Kingdom in 2016. Sixteen percent (16%) of these deaths occurred between the ages of 30–70 years, causing a significant loss in productivity and human resources. Advancements in the field of cardiology and cardiac surgery are therefore needed to prevent such deaths.

Cardiac surgery is a relatively new specialty less than a century old, and the history of cardiac anesthesia is intertwined with it. The success of these surgeries is due to invasive and noninvasive monitoring “supervised” by the cardiac anesthesiologist, warning the team members earlier about the physiological derangements. Open-heart surgeries were not possible before the 1950s, but since then the introduction of the cardiopulmonary bypass, hypothermia, and deep hypothermic circulatory arrest have allowed more complicated surgeries to be performed with better outcomes than were possible earlier.

Recently, ultrasound and transesophageal echocardiography have been added to the armamentarium of the cardiac anesthesiologist. Knowledge of blood coagulation and anticoagulation and various drugs that are employed to modify the coagulation cascade is also required.

The purpose of post-graduate medical education is to produce highly skilled physicians who practice safely and meet the healthcare needs of society. Medical educators, trainees, patients, and society recognize that being well trained in the scientific aspects of medicine is necessary, but alone is insufficient for effective medical practice. The Canadian Medical Education Directives for Specialists (CanMEDS) framework, which is applied in post-graduate training programs in many countries, offer a model of physician competencies that emphasizes not only medical expertise but additional non-medical expert roles that aim to competently serve society’s needs.

In the last analysis, quality and safety are two inseparable parts of the practice of cardiac anesthesia, which necessitate that new procedures adopted in cardiac interventions or cardiac surgery be equally understood by anesthesiologists as by their peers in this specialty, thus improving the patient experience of care in terms of satisfaction and the judicious utilization of hospital resources.

2. Goals and Objectives

The cardiac anesthesia fellowship program spans two years. The aim of the program is to enable cardiac anesthesiologists to independently provide specialized cardiac anesthesia care at the consultant level in elective and emergent scenarios. At the end of training, the fellow is expected to have acquired the professional skills, knowledge, and attitudes to equip her/him to professionally meet the expected standards of practice as a consultant in various areas of the field of cardiac anesthesia:

a) Perioperative management of adult patients for any cardiac surgery/cardiology interventions;
b) Perioperative management of adult cardiac patients for non-cardiac interventions;
c) Perioperative management of children with CHD undergoing most cardiac surgery/cardiology interventions;
d) Perioperative management of children with CHD for non-cardiac procedures;
e) Basic and intermediate levels of intraoperative TEE management;
f) Team management;
g) Teaching activities;
h) An active role in administrative duties; and
i) Research.

3. Context of Practice

Cardiac Anesthesiology arose as a super-specialty of anesthesia because of the dangers associated with anesthetic medications and techniques in a challenging cardiac patient. It is necessary that these drugs be administered by a skilled and knowledgeable physician. As safer medications were developed and physiological monitoring improved, the need for cardiac anesthesiologists was propelled by increasing surgical complexity and severity of illness as well as increasing expectations for patient safety.

This curriculum is designed to train the fellows in the principles and practice of cardiac anesthesia and in functioning as consultants in the discipline.

4. What is New in This Edition

As the first edition of the curriculum was published in 2008, there is a strong need to update the curriculum and incorporate the changes in practice that have happened over the past decade. The Saudi Commission for Health Specialty (SCFHS) is now adopting a competency-centered training model within the confines of time-based training. Emphasizing such competencies will improve training quality, patient well-being, and in general the healthcare system itself. A structured, competency-based cardiac anesthesia curriculum will better prepare the trainee fellows for independent practice and protect patients from avoidable complications. The curriculum gives in detail the required basic and advanced cardiac anesthesia knowledge and methods of achieving objectives at different levels of training. A structured curriculum enables close monitoring of the competency milestones to ensure that those promoted to higher training levels have attained the prerequisite capabilities.

5. Policies and Procedures

This curriculum presents the means and materials outlining the learning objectives in accordance with which trainees and trainers will interact to achieve the identified educational outcomes. This curriculum fulfills all the criteria and executive policies published by the Saudi Commission for Health Specialties (SCFHS) that regulate all processes related to training. It includes the general bylaws of training, assessment, and accreditation, as well as executive policies on admission, registration, continuous assessment and promotion, examination, trainee representation and support, duty hours, and leave.

6. Abbreviations Used in This Document

Abbreviation	Description
AHA	American Heart Association
ACC	American College of Cardiology
ACICU	Adult Cardiac Intensive Care Unit
ACLS	Advanced Cardiac Life Support
ASD	Atrial Sepal Defect
AED	Automated External Defibrillator
BLS	Basic Life Support
BT Shunt	Blalock-Taussig Shunt
BMV	Balloon Mitral Valvotomy
BIS	Bispectral Index
CABG	Coronary Artery Bypass Grafting
CHF	Congestive Heart Failure
CHD	Congenital Heart Disease
CBF	Cerebral Blood Flow

CSICU	Cardiac Surgical Intensive Care
COPD	Chronic Obstructive Pulmonary Disease
CPB	Cardiopulmonary Bypass
CO	Cardiac Output
CVS	Cardiovascular System
CVP	Central Venous Pressure
CT	Computed Tomography
CCU	Cardiac Care Unit
CBE	Competency-Based Education
CBD	Case-Based Discussion Report
COT	Consultation Observation Tool
DDAVP	Desmopressin
2D	Two-Dimensional
DOPS	Direct Observation of Procedural Skills Report
ECG	Electrocardiograph
ESWL	Extracorporeal Shockwave Lithotripsy
EP	Electrophysiology
ECMO	Extracorporeal Membrane Oxygenation
FITER	Final In-Training Evaluation Report
FHR	Fetal Heart Rate
FFP	Fresh Frozen Plasma
HR	Heart Rate
IHD	Ischemic Heart Disease
ICU	Intensive Care Unit
ICP	Intracranial Pressure
IABP	Intra-Aortic Balloon Pump
INR	International Normalized Ratio
LV	Left Ventricle
LMWH	Low Molecular Weight Heparin
MODS	Multi Organ Dysfunction Syndrome
MID-CAB	Minimally Invasive Direct Coronary Artery Bypass
MV	Mitral Valve
NIRS	Near Infrared Spectroscopy
NICU	Neonatal Intensive Care Unit
OR	Operative Theater
PET	Positron Emission Tomography
PRBC	Packed Red Blood Cell
PAP	Pulmonary Artery Pressure

PALS	Pediatric Advance Life Support
PA	Pulmonary Artery
PTCA	Percutaneous Transluminal Coronary Angioplasty
PDA	Patent Ductus Arteriosus
PACWP	Pulmonary Artery Capillary Wedge Pressure
PV	Pulmonary Valve
PSICU	Pediatric Surgical Intensive Care Unit
RV	Right Ventricle
SAM	Systolic Anterior Motion of the Mitral Valve
TOF	Tetralogy of Fallot
TAAA	Thoracic Abdominal Aortic Aneurysm
TAVI	Transcatheter Aortic Valve Implementation
TAVR	Transcatheter Aortic Valve Replacement
TEE	Transesophageal Echocardiography
TGA	Transposition of Great Arteries
SCFHS	Saudi Commission for Health Specialties
F(1)	(First) Year of Fellowship
PT	Progress Test
OSCE	Objective Structured Clinical Examination
OSPE	Objective Structured Practical Examination
Mini-CEX	Mini-Clinical Experience Report
ITER	In-Training Evaluation Report
COT	
RTC	Residency Training Committee

2. RESPONSIBILITIES

Fellows' Responsibilities

Under the one-to-one supervision of the consultants, fellows are expected to:

a) Be responsible for the anesthetic care of adult and pediatric cardiac patients;
b) Perform daily preoperative assessment;
c) Communicate with supervising staff regarding upcoming cases;
d) Perform scheduled on-call adult and pediatric cardiac anesthesia duties for at least twelve (12) months of their training. The nature of this schedule will be determined by the program director of the institute.
e) General guidelines for on-call duties are as follows:
    - Total number of calls per month is 7–10 days (home calls)
    - Total number of calls per month should not exceed six (6) days (in-house calls)
    - The chief fellow will prepare the call schedule
    - It is mandatory to review all cases with the anesthesiologist on call
    - Provide consultation to other services in the hospital
    - Participate in educational and academic activities in the department
    - Maintain a log book of all anesthetics administered, and procedures performed (Appendix I)
    - Teach junior staff and attend at least 80% of educational department activities (please refer to the latest updated policy on the SCFHS website)
    - Perform clinical research/quality projects supervised by senior staff starting in first year

Scientific Committee Responsibilities

a) The Scientific Committee will supervise and guide the fellowship program in accordance with this document and the General Standards for Subspecialty Training Program.
b) The Scientific Committee sets educational standards for the training and certification of candidates.
c) The Scientific Committee prepares In-Training Evaluation Reports (ITER) and Final In-Training Evaluation Reports (FITER) for candidate fellows.
d) The Scientific Committee promotes adult and pediatric cardiac anesthesia at the public level and assumes the responsibility of educating lay society about adult and pediatric cardiac perioperative care.
e) The Scientific Committee develops reference practice guidelines that can be adopted and modified by local hospitals as needed to promote a unified standard of care within KSA.
f) Members of the Committee will be the Fellowship Program directors of their respective hospitals, if possible.

Hospital Program Director Responsibilities

a) Advise the chairperson and the Committee as necessary.
b) Coordinate the Fellowship Program. This includes fostering projects, teaching, topic checklist, logbook, and liaising with teaching staff.
c) Revise and update the curriculum every 4 years according to the needs of the Curriculum Department of SCFHS.
d) Be responsible for scheduling the fellows at various departments and hospitals.
e) Receive the evaluations of fellows after each clinical rotation, collate, and report to the Committee every three (3) months.
f) Report any concerns about the performance of the follows to the Committee.
g) Meet with fellows at least once a month, and more frequently whenever possible.

Hospital Teaching Staff Responsibilities

a) The teaching staff will consist of experienced adult and pediatric cardiac anesthesiologists who have finished cardiac anesthesia training in a recognized hospital.
b) Teaching staff may consist of general anesthesiologists with multiple years of continuous care of adult, neonates, infants, and children with cardiac disease.
c) Teaching staff are expected to supervise and teach fellows during their clinical duties.
d) Teaching staff are expected to debrief the fellows with regard to their level of performance and to follow up their daily evaluation.
e) Consultants in the adult (ACICU), pediatric (PICU), and neonatal intensive care units (NICU) will supervise fellows for the ICU components of their training.

3. HOLIDAYS, VACATIONS, AND INTERRUPTION OF TRAINING

As per SCFHS postgraduate rules and regulations, for which see: www.scfhs.org.sa

4. MENTORSHIP DURING FELLOWSHIP TRAINING

Guidelines for Mentors

Fellows will have access to mentors during their training via this link to the SCFHS mentors' manual: http://www.scfhs.org.sa/Pages/default.aspx

Goals

- Guide fellows towards personal and professional development through continuous monitoring of progress
- Early identification of struggling fellows as well as high achievers
- Early detection of fellows who are at risk of emotional and psychological disturbances
- Providing career guidance

5. STRESS DURING FELLOWSHIP TRAINING

Stress During Fellowship Training

Recognizing that fellowship training can be a period of physical, mental, and emotional stress, the Program Director provides continuous support for fellows in the program. In some instances, a review of the fellow's personal concerns may be discussed at the Scientific Committee Meeting.

Stress Counselling

Some fellows may experience stress during training due to multiple factors. Any fellow experiencing such issues can meet with the Program Director to seek advice. The Scientific Committee will be asked to help with such issues if the Program Director requests. The Scientific Committee will generate a report with recommendations. The Committee may request additional members to join the Committee and help with resolution of the matter as needed.

6. PROGRAM STRUCTURE

1. Program Admission Requirements

In addition to the SCFHS general training policy, which requires classification by SCFHS as senior registrar, medical and physical fitness, and payment of tuitions due, the following requirements must be fulfilled by any candidate accepted into the training program:

a) All candidates must hold an SCFHS Certification in General Anesthesia or be enrolled in a SCFHS-approved training program in general anesthesia. All candidates must be certified in their primary specialty in order to be eligible to sit the SCFHS examination in cardiac anesthesiology. 2) All candidates must provide a comprehensive CV with references from two (2) consultants, preferably from the field of cardiac anesthesiology. These referees should provide recommendation letters stating the suitability of the candidate regarding training in cardiac anesthesiology.
b) All candidates must provide a letter from a sponsoring organization. This should state that the organization pledges its support for the candidate throughout the total period of training, i.e., two years, and for sponsored positions.
c) All candidates must be registered as receiving training in cardiac anesthesiology at the SCFHS.
d) All candidates must have basic life-support certification.
e) All candidates must have valid malpractice insurance.

2. General Training Requirements

a) Trainees shall abide by the training regulations and obligations set by the SCFHS.
b) Training is a full-time commitment. Fellows will be enrolled in full-time, continuous training for the program's duration.
c) Training is to be conducted in institutions accredited for training by the Saudi Board of Cardiac Anesthesiology.
d) The training will comprehensively cover specialties related to cardiac anesthesia.
e) Trainees should be actively involved in patient care, with a gradual progression of responsibility.

3. Program Duration and Rotations

This training involves two (2) years of training in an approved Cardiac Anesthesia Fellowship program. The following core experiences are mandatory:

1. A minimum of nine (9) four-week blocks of Adult Cardiac Anesthesia Fellowship rotation involving the perioperative management of the following:
   a) CABG surgery with and without CPB.
   b) Valve surgery with or without CABG.
   c) Adult congenital heart surgery.
   d) Minimally invasive valve surgery requiring one lung ventilation.
   e) Cardiac patients for non-cardiac surgery.
   f) Heart and lung transplantation.
   g) Ascending thoracic aorta or descending thoracic or abdominal aortic surgeries requiring left atrial to femoral CPB.
   h) Hybrid cardiac procedures.
   i) A minimum of 40 cases, with invasive monitoring line insertion are required.
2. A minimum of eight (8) four-week blocks of Pediatric Cardiac Anesthesia Fellowship rotation involving the perioperative management of the following
   a) Congenital heart patient for cardiac surgery with or without CPB.
   b) Cardiac pediatric patient for non-cardiac surgery.
   c) A minimum of 40 cases, with invasive monitoring line insertion are required.
3. A minimum of one (1) four-week block in Adult Post Cardiac Surgery Cardiac Surgical Intensive Care (ACSICU).
4. A minimum of one (1) four-week block in Pediatric Post Cardiac Surgical Intensive Care (PCSICU).
5. A minimum of two (2) four-week blocks of TEE, with at least 10 cases during this period.

6. A minimum of three (3) four-weeks blocks in remote area anesthesia:
   a) Adult and pediatric cath-lab, 20 cases required.
   b) Electrophysiology lap patients, 10 cases required.
   c) Cardiac MRI patients, 10 cases required.
   d) CT-angio patients, 10 cases required.

Rotation	Duration (each block is 4 weeks)
Year One (1)	
Adult Cardiac Anesthesia	**8 blocks**
Adult Cardiac Surgical ICU	**1 block**
TEE	**1 block**
Remote Area Anesthesia	**1 block**
Annual Leave	**1 block**
Clinical Research	**1 block**
Year Two (2)	
Pediatric Cardiac Anesthesia	**8 blocks**
Pediatric Cardiac Surgical ICU	**1 block**
TEE	**1 block**
Remote Area Anesthesia	**1 block**
Annual Leave	**1 block**
Clinical Research	**1 block**

7. DESCRIPTION OF ROTATIONS IN THE PROGRAM

1. Introduction to Learning Objectives and Competency-Based Education

Graduates of this program will be eligible to become consultants as per SCFHS rules and regulations. Cardiac anesthesia is a specialty in which comprehensive anesthetic care is delivered to all age group patients, taking in account the their physical, developmental, emotional, and psychological influences.

The program provides the fellows with skills that go beyond the usual interface of anesthetic care and equip them to undertake the following:

i) Improvement in their anesthetic and clinical skills so as to develop treatment strategies for the management of cardiac patients.
ii) Arranging a comprehensive multidisciplinary care plan for patients with advanced disease.
iii) Demonstration of the scientific basis of the procedures performed by the fellows and incorporation of this understanding in their clinical decision making & patient management.
iv) Recognition of the multiple comorbidities present in cardiac patients across all age groups.
v) Acquiring the research skills related to study design & methodology for comprehensive literature reviews as well as critical analysis of scientific articles.
vi) Acquiring the skills needed to teach and become educators of the future.

At the end of this program, the fellow will have acquired the following competencies and be able to function effectively in these roles as per CanMEDS framework competencies:

a) Medical Expert
b) Communicator
c) Collaborator
d) Manager
e) Health Advocate
f) Scholar
g) Professional

Competency-based education (CBE) is a learning approach based on achieving predefined, fine-grained, and well-paced learning objectives that are driven by complex professional competencies. CBE will change the classical way of clinical education. Although time of training is the most valuable resource, it should not be considered a proxy for competence. Furthermore, competency-based education emphasizes the critical role of an informed judgement of the learner's progress, based on staged and formative assessments driven by multiple workplace-based observations as proposed by educational models of recognizable medical education bodies, such as CanMEDS by the Royal College of Physicians and Surgeons of Canada and the Competency-Based Medical Education (CBME) model of the Accreditation Council for Graduate Medical Education (ACGME).

2. Mapping of Milestones

Milestones are a new feature of CanMEDS 2015 (part of the Competence by Design CBD project) and reflect the abilities expected of a health care professional at a given stage of experience. These milestones ensure perpetuity in learning and training. The CBD approach divides the specialist training into a series of inter related stages whereby the fellow develops proficiencies in different stages of their training and continue them in their clinical practice. These stages are as follows.

a) Transition to discipline
   This is the preparatory stage, emphasizing the clinical knowledge and skills of the fellows.
b) Foundation of discipline
   This stage focuses on scientific research and basic core science before moving to advanced specialty related competencies.

c) Core of discipline
This stage covers the core competencies that make up a large portion of the discipline. It begins with the basic specialty and progresses to become more advanced and complex during the final year of fellowship training.

d) Transition out of practice
In this last stage, the fellows adapt to the final practice period and their changing health care role. By the end of this stage, the fellow will be awarded a certification of cardiac anesthesia and can practice as a consultant.

e) Continuing Professional Development
Even after the certification, the practicing consultant must maintain progress in competence to attain expertise during continuing professional development.

During their training program, the fellows are exposed to a number of cases from different training centers. Their responsibility increases and becomes more diverse with each passing day, starting with proper cardiac anesthetic preoperative evaluation, devising the anesthetic plan, and implementing the appropriate management according to the patient's condition.

During their first year, the fellows have the responsibility for examination, collecting full patient records and data, and discussing the anesthetic plan with their consultants. They also perform procedures under supervision with regular debriefing afterwards. The second-year fellows have greater responsibility for management of advanced cases, in addition to teaching their juniors under minimum supervision by a consultant.

The following milestones are expected to be achieved during the training time period.

MILESTONES	FIRST YEAR	SECOND YEAR	CONSULTANT
MEDICAL EXPERT The cardiac anesthesiologist should be competent to recall, analyze, and apply a broad and deep fund of knowledge to professionally care for complicated patients and be able to: • Obtain a detailed yet pertinent preoperative anesthetic evaluation. • Arrange the logistics needed for the safe conduct of anesthetic care. • Perform airway and vascular access with or without instrumental guidance. • Outline the patient management plan. • Manage common and important perioperative problems. • Improve their clinical decision-making skills so as to function	• Fellows have limited knowledge and skills but broad competencies under close supervision. • Their attitude is accepted as developing. • Their attitude is accepted as developing.	• Fellows show knowledge and experience as specialists in different areas without close supervision. • They perform procedures as expected of a specialist. • Their attitude develops as expected of a specialist.	• At this level, the cardiac anaesthesiologist carry through their competencies and continue to develop professionally & update the skills within the area of their practice.

independently at the senior level. • Understand the use and interpretation of ancillary evaluating tools for cardiac functions.			
COMMUNICATOR	• Fellows can actively attend to a patient's inquiry • Fellows can demonstrate to disclose pertinent non-verbal body language to show attentiveness, interest and responsiveness to patient care	• Fellows provide information on anesthetic management in a clear, compassionate, respectful, and objective manner. • Fellows use appropriate non-verbal behavior to enhance communication with patients. • Fellows assist discussions with patients and families in a dignified and safe environment.	• Cardiac anesthesiologists demonstrate non-verbal communication skills in difficult situations. • They impart others how to use non-verbal communication to improve rapport. • They are role models for their colleagues.
COLLABORATOR	• Fellows respect the accepted rules of their team. • Fellows obtain and respond pertinently to the advice from other health care professionals. • Fellows ascertain the difference between task and relationship concerns among the health care professionals .	• Fellows work constructively with other colleagues in the care of patients. • Fellows institute & observe healthy and positive working relationship with other health care professionals.	• Cardiac anesthesiologists participate in the policy making related to collaborative care. • Cardiac anesthesiologists teach, assess, and utilize a model of collaborative care. • Cardiac anesthesiologists use electronic medical record tools to improve collaboration in health care.
LEADER	• Fellows describe the process for reporting adverse events and medical errors.	• Fellows analyze the adverse events and medical errors to enhance system	• Cardiac anesthesiologists contribute to improving health care delivery in

	• Fellows determine cost discrepancies between the best practice and their current practice.	of care. • Fellows tend to ensure the cost-effective utilization of the equipment and tools in their practice. • Fellows evaluate a problem, set priorities, execute the plan, and analyze the results.	teams, organizations, and systems. • Cardiac anesthesiologists design processes that balance standardization and variability to reduce medical errors and ensure patient safety in the delivery of health care. • Cardiac anesthesiologists mentor and guide others to establish leadership and motivational skills.
HEALTH ADVOCATE	• Fellows acknowledge individual patient's health requirements by upholding them within & beyond the clinical environment. • Fellows explore individual patient's requirement for health services within the scope of their specilaty. • Fellows choose pertinent patient educational tools related to their specialty.	• Fellows seek the principles of behavioral modification while conversing with patients to enhance their health care. • Fellows participate in a process to educate the general public about the safe conduct of cardiac anesthesia.	• Cardiac anesthesiologists integrate with associations & supervisory programs to recognize the needs at the population level. • Cardiac anesthesiologists plan or lead the implementation of programs to improve the health of the community.
SCHOLAR	• Fellows assess & revise earlier learning plans with advice from others. • Fellows demonstrate basic skills in teaching others. • Fellows exhibit cognizance of the importance of	• Fellows create a learning plan, incorporating all the CanMEDS domains. • Fellows explore learning plan & approach for continuing supervision with a mentor & a faculty advisor.	• Cardiac anesthesiologists develop a plan to enhance competence across all CanMEDS domains for practice and update it as needed. • Cardiac

	scientific research & investigate its constraint and applicability.	• Fellows conduct scientific research.	anesthesiologists plan methodical process for the appraisal of learners and evaluation of programs. • Cardiac anesthesiologists conduct and publish scientific research in academic journals.
PROFESSIONAL	• Fellows exhibit an aptness to regulate emotions, tensions, thought & attitude while maintaining the their capability to perform the professional assignments.	• Fellows exhibit dedication to patients by following best practices & cohering to the highest moral standards.	• Cardiac anesthesiologists demonstrate pertinent professional attitude, integrity, honesty, commitment, esteem & compassion. • Cardiac anesthesiologists serve as role models and teach professionalism to learners and colleagues.

3. Continuum of Learning

Learning should continue in each key stage of progression within the specialty. Fellows are reminded of the need for lifelong Continuing Professional Development (CPD). They should keep in mind the necessity of CPD for every healthcare provider in order to meet the demands of their vital profession. The following table states how the fellow's role is progressively expected to develop through training to the consultant level.

QUALITIES EXPECTED TO BE ACHIEVED	FIRST YEAR OF TRAINING	SECOND YEAR OF TRAINING	CONTINUING PROFESSIONAL DEVELOPMENT
Practice of the specialty	Dependent/ supervised practice	Dependent/ supervised practice	Independent practice/ provide supervision
Trustworthiness	Approaching entrustable	Approaching entrustable	Entrustable
Obtain basic health science and foundational level of core discipline knowledge	Obtain fundamental knowledge related to the core clinical problems of the specialty.	Apply knowledge to provide appropriate clinical care related to the core clinical problems of the specialty.	Acquire advanced and up-to-date knowledge related to the core clinical problems of the specialty.

Internship to the practice of the discipline	Apply clinical skills such as physical examination and practical procedures related to the core presenting problems and procedures of the specialty.	Analyze and interpret the findings from clinical skills to develop an appropriate management plan for the patient.	Compare and evaluate challenging and contradictory findings and develop expanded differential diagnoses and management plans.

8. ADULT CARDIAC ANESTHESIA

Objective

To allow the fellow to acquire the particular intellectual skills necessary to conduct anesthesia care for high-risk cardiovascular patients.

1. Medical Expert

The fellow will demonstrate knowledge of the basic sciences as applied to the preoperative, intraoperative, and postoperative periods of cardiovascular surgery.

A. Physiology and Anatomy

The fellow is expected to:

a) Demonstrate knowledge of general internal medicine, anatomy, physiology, and pharmacology with particular reference to the cardiovascular, respiratory, hepatic, renal, and coagulation systems, blood transfusion, and acid–base, fluid, and electrolyte balance
b) Describe the normal coronary anatomy and variants, normal cardiac physiology, and effects of disease states on normal physiology
c) Describe the anatomy and physiology of the cardiac valves, left ventricle, right ventricle, atria, major cardiac vessels, and circulatory system in both normal and diseased states
d) Describe the normal conduction pathways of the heart and their clinical significance in disease
e) Describe the embryologic circulation, development of the heart, and fetal physiology as it applies to adult congenital heart disease
f) Describe thoracotomy and pulmonary physiology, pulmonary, open and closed-chest ventilation, ventilation/perfusion mismatch, pulmonary airway mechanics, and one-lung ventilation
g) Describe the altered respiratory physiology of the immediately postoperative ventilated patient with significant surgical incisions and pain (sternotomy, large abdominal incision)
h) Know the metabolic effects of surgery
i) Know the endocrine response to anesthesia and surgery
j) Know the PFT and interpretation
k) Describe CBF, ICP autoregulation
l) Describe common physiological changes occurring in the postoperative period and the impact these have on end-organ function (neurologic, renal, cardiac, hepatic, gastro-intestinal)
m) Know the epidemiological, medical, and surgical aspects of vascular disease (pathophysiology of atherosclerosis, natural history of patients with peripheral vascular disease, medical therapy of atherosclerosis)

B. Pathophysiology

The fellow should know:

a) Shock, heart and hemodynamic failure, congenital defects, COPD, cardiopulmonary reserves, acquired cardiac and pulmonary diseases
b) Cardiomyopathy
c) Vascular pathology
d) Immunological and metabolic response during CPB
e) Diagnosis and management of altered lung function, infection prevention
f) Total circulatory arrest

C. Pharmacology

The fellow should know:

a) Commonly prescribed medications for cardiac surgical patients, the implications for disease, and the impact on anesthetic management

b) Commonly used cardiac anesthetics, titration, and dosages
c) The effect of commonly used anesthetic agents on cardiac function
d) How these effects may lead to a particular choice of drug for a patient with a particular cardiac lesion (e.g., use of myocardial depressant for patients with LV outflow obstruction from SAM)
e) Antiarrhythmic drugs, nitric oxide
f) Heparin, antiplatelet agents, and anesthetic implications
g) Protamine for heparin reversal, along with side effects and complications
h) Antifibrinolytic agents, mechanisms of action, and indications
i) The use of blood products (PRBC, FFP, platelets, cryoprecipitate) and blood alternatives (albumin, starch) as well as transfusion reactions and complications
j) Coagulation drugs (DDAVP, activated factor VIIa), their indications, contraindications, dosages, and complications
k) Commonly used vasodilators, vasoconstrictors, inotropic agents, and their indications, dosages, and side effects
l) The appropriate use of pain medications, non-steroidal anti-inflammatory drugs, and regional anesthetic techniques in cardiac surgical patients
m) Pharmacology of perioperative risk reduction strategies (lipid lowering agents, β-blockers, aspirin)
n) Total circulatory arrest, pharmacokinetics and pharmacodynamics of anesthetic and vasoactive drugs
o) Biochemical reactions and applied concepts
p) Antibiotics and bronchodilators

D. Physics

The fellow should know:

a) Basic principles of the monitoring devices and their role in interpretation of the results
b) Basic principles of the analyzing and measuring devices
c) Lasers in cardiac surgery
d) Electronics, computing of patients' data
e) Equipment in the operative theater and that used for transport of patients
f) Physics of ultrasound and ECHO
g) Heart-lung machine and types of centrifuge
h) ICU equipment
i) Robotic technique

E. Monitoring

The fellow is expected to:

a) interpret ECG for ischemia, infarction, arrhythmias, and paced rhythms, and recognize the limitations and the sensitivity/specificity of ECG as an ischemia monitoring tool
b) Review and discuss routine cardiac catheterization lab reports
c) Demonstrate the principles of noninvasive and invasive blood pressure monitoring and its pitfalls
d) Acquire skills of arterial and central venous cannulation (with ultrasound), peripheral venous cannulation, and pulmonary artery catheterization
e) Interpret CVP and data from PA catheter (PAP, PCWP, cardiac output) and know its indications, complications, and management
f) Understand the basics of introductory TEE, including techniques of probe insertion and several basic views, and its implication and application to the critically ill patient
g) Understand laboratory monitoring of the coagulation system (PTT, INR, fibrinogen) as applied to the cardiac patient
h) Assess the adequacy of mechanical ventilation using clinical parameters and laboratory arterial blood gas analysis
i) Recognize the parameters used to assess intraoperative blood loss and options to treat blood loss including medical and surgical alternatives

j) Know the significance of temperature management in the intraoperative period, including hypothermic techniques and the importance of normothermia during beating heart procedures
k) Understand the indicators of volume status, especially when weaning from bypass, and including the findings from invasive monitors, TEE, and clinical indicators (urine volume)
l) Use appropriate intraoperative blood work for the management of patient care, and be aware of new monitoring devices (noninvasive CO, BIS) and their potential applications during cardiac surgery

F. Clinical Assessment and Management

The fellow is expected to:

a) Perform the preoperative evaluation and preparation of the cardiovascular patient
b) Complete a detailed history, perform a physical exam, order appropriate laboratory and ancillary investigations, and provide a management plan for a cardiac surgical patient
c) Know the clinical predictors of increased perioperative CVS risk:
    - Type of surgery
    - ACC/AHA guidelines on perioperative cardiovascular evaluation
    - Coronary artery disease
    - Heart failure
    - Cardiac valvular disease
    - Diabetes mellitus
    - COPD and tobacco abuse
    - Renal failure
    - Cerebrovascular disease
d) Assess and optimize coexisting disease (coronary artery disease, heart failure), risks vs benefits of coronary revascularization before noncardiac surgery, and implications of PTCA and stenting before non-cardiac surgery
e) Know the optimal timing of noncardiac surgery after PTCA and stenting
f) Know current indications and recommendations for SBE prophylaxis
g) Assess anesthetic risk and optimize/prepare adult patients for cardiac surgery
h) Be able to apply/insert (and instruct) invasive and other monitoring and therapeutic devices, including but not limited to:
    - Arterial catheters
    - Central venous catheters (subclavian, internal jugular, external jugular, femoral)
    - Pulmonary artery catheters
    - Lumbar spinal drains (for thoracoabdominal aneurysms)
    - TEE probes
    - Esophageal pacers
    - Lumbar and thoracic epidural catheters
    - Expired oxygenation gas monitoring
    - Interpret data obtained from these monitoring devices
    - Invasive arterial blood pressure monitoring
    - Pulmonary artery (PA) catheter monitoring
    - PA waveforms and pulmonary capillary wedge (PCW) tracings
    - Cardiac output by thermodilution and waveforms
    - Mixed venous oxygen saturation
    - Transesophageal echocardiography
    - Cerebral oximetry
    - Activated clotting time
    - Thromboelastograph
i) Choose and articulate appropriate anesthetic techniques for patients with different types of cardiovascular disease
j) Demonstrate knowledge of the principles and practice of anesthesia as they apply to patient support during cardiovascular surgery
k) Conduct high quality and safe anesthesia and analgesia for cardiac patients

l) Manage medical bleeding, and consider hematologic parameters in cardiovascular surgery:
- Normal hemostasis
- Laboratory evaluation
- Congenital bleeding disorders
- Acquired bleeding disorders
- Platelet defects
- Hypercoagulable states
- Venous thrombosis
- Antithrombin III deficiency
- Protein C deficiency
- Protein S deficiency
- Defects in fibrinolysis
- Anticoagulant therapy:
  i. Heparin
  ii. LMWH
  iii. Heparinoids
  vi. Coumadin
  v. Platelet inhibitors
  vi. Herbal therapy
- Thrombolytic therapy:
  i Pentoxifylline
- Procoagulant therapy:
  i Tranexamic acid
  ii Desmopressin
- Intraoperative blood loss and replacement
- Postoperative bleeding and reoperation

m) Correct common derangements in metabolic and electrolyte disturbances in the intraoperative period

n) Know intraoperative anesthesia management for the patient undergoing cardiopulmonary bypass, how to initiate and how to discontinue it

o) Understand the key points of weaning from CPB:
- Preparation checklist, teamwork
- Identify at-risk patients for difficult CPB weaning
- Weaning plan based on patient pathophysiology
- Options for managing ventricular failure and afterload

p) Demonstrate the ability to practice fast-track anesthesia to appropriate patients

q) Know the common pathophysiology and management of patients with complications of:
- Coronary artery disease, acute myocardial ischemia and infarction, complications of myocardial infarction, and thrombolytic therapy
- Valvular heart disease and valve replacement or repair
- Aortic dissection, thoracic and thoracoabdominal aortic aneurysm
- Shock and the use of volume resuscitation, vasodilators/constrictors, inotropes, and lusitropes
- Emergencies requiring ACLS
- Cardiac tamponade, constrictive pericarditis
- Dilated, restrictive and obstructive cardiomyopathy, CHF, and diastolic dysfunction.
- Aberrant conduction, dysrhythmia, sudden acute and subacute ventricular and supra-ventricular arrhythmia
- Pacemakers and the indications for and applications of the various modes of temporary pacing
- Pneumo-hemothorax
- Pulmonary edema, pneumonia, CHF
- COPD, asthma, sleep apnea in the ventilated patient
- Heparin-induced thrombocytopenia and heparin resistance
- Neurologic risk stratification during CPB procedures
- Renal failure and its management
- Diabetes and endocrine control, and the implications of hyperglycemia

r) Know the risk management during the transfer process and maintain continuity of care in accordance with the anesthetic plan by appropriate CSICU transfer procedures

G. Special Topics Pertaining to Adult Cardiac Anesthesia

Valvular Heart Disease and Surgeries

- Mitral stenosis
- Aortic stenosis
- Hypertrophic cardiomyopathy
- Mitral regurgitation
- Pulmonary stenosis
- Tricuspid stenosis
- Tricuspid regurgitation
- Mixed valve lesions
- Infective endocarditis
- Anesthesia management of valvular heart lesions through sternotomy approach
- Anesthesia management of minimally invasive valvular heart lesions through thoracotomy with lung isolation

Anesthesia for Coronary Artery Bypass Grafting

- Anesthesia for on-pump coronary artery bypass grafting
- Anesthesia for off-pump coronary artery bypass grafting
- Anesthesia for minimally invasive direct coronary artery bypass surgery (MID-CAB)

Anesthesia for Vascular Surgery

- Preanesthetic evaluation
- Perioperative medical therapy
- Lower extremity revascularization
- Carotid artery revascularization
- Aortic reconstruction
- Thoracoabdominal aortic aneurysm (TAAA)
- Special considerations
- Endovascular surgeries

Anesthesia for Pericardiectomy

- Anesthetic considerations
- Intraoperative

Anesthesia for Cardiac Catheterization: Laboratory Procedures

- Anesthesia challenges
- Diagnostic procedures
- Interventional procedures
- Preoperative evaluation
- Procedures
- Anesthetic implications of pacemakers
- Anesthesia considerations
- Monitoring
- Specific procedures and effects of pacemakers
- Diagnostic catheterization

Pregnancy and Cardiac Surgery

- General considerations in pregnant patients

- BMV in pregnancy
- Open heart surgery in pregnancy
- Normal findings in pregnant patients
- Timing of cardiac surgery in pregnancy
- Cardiopulmonary bypass and pregnancy
- Fetal heart rate (FHR) monitoring
- Uterine monitoring
- Anesthetic drugs
- Pregnancy and myocardial infarction
- Pregnancy and heart transplant

Anesthesia for Cardiac Patients for Noncardiac Surgery

- Management of patients with ischemic heart disease for noncardiac surgery
- Preoperative evaluation and identification of risk factors
- Intraoperative management
- Regional anesthesia and IHD
- Monitoring
- Induction
- Maintenance of anesthesia
- Intraoperative ischemia
- Postoperative management
- Management of valvular heart disease for noncardiac surgery
- Mitral stenosis
- Mitral regurgitation
- Mitral valve prolapse
- Aortic stenosis

Cardiovascular Concerns in Neurosurgical Procedures

- Cardiovascular concerns during management of raised intracranial pressure
- Cardiovascular concerns during prevention of cerebral injury
- Cardiovascular concerns in intracranial pathology
- Cardiac emergencies during neurosurgical procedures
- Neuropharmacological interventions and cardiovascular concerns
- Management of bradycardia and asystole during neurosurgery

Cardiovascular Concerns in Urosurgical Procedures

- Nephrectomy/pyeloplasty
- Radical nephrectomy
- Radical cystectomy and ileal conduit
- Transurethral resection of prostate (TURP)
- Extracorporeal shock wave lithotripsy (ESWL)
- Renal transplant

Cardiovascular Concerns in Major Orthopedic Surgeries

- Choice of anesthesia

Cardiovascular Concerns in Plastic Surgeries

- Liposuction and abdominoplasty
- Burns

Cardiac Disease and Liver Surgery

- Congenital cardiac disease

- Valvular heart disease
- Ischemic heart disease
- Liver transplant

Cardiovascular Concerns During Liver Transplantation

- Preoperative cardiac investigations
- Pathophysiological changes in the cardiovascular system related to liver failure

Cardiovascular Concerns in General and Emergency Abdominal Surgery

- Pacemaker and anesthesia management
- Anesthetic management
- Postoperative pain management

Postoperative Analgesia for Cardiac Surgical Patient

- Pathophysiology of cardiac surgical pain
- Beneficial effects of adequate postoperative analgesia
- Modalities for postoperative analgesia

2. Communicator

a) Demonstrate effective communication with patients and families (description of procedures, informed consent, anesthetic options, and risks)
b) Demonstrate effective communication with OR team (cardiac surgeons, nurses, perfusionists) and postoperative team, particularly during the initiation, conduct, and removal of cardiopulmonary bypass
c) Provide clear and concise written consultation and anesthetic records

3. Collaborator

a) Recognize the need to utilize other specialists for the care and management of the critical patient
b) Foster healthy team relationships
c) Seek perioperative consultation with colleagues when required, and contribute effectively to other interdisciplinary team activities by demonstrating the ability to function in the clinical environment using the full abilities of all team members

4. Manager

a) Manage OR time by efficiently conducting anesthetics, continuing education, and personal activities
b) Demonstrate the ability to practice cost-effective and safe anesthesia, and use medical informatics to learn about the various cardiovascular medical conditions in patients presenting for cardiovascular surgery
c) Make effective use of healthcare resources

5. Health Advocate

a) Exhibit the approach to reduce the risks, including the sterile techniques and use of ultrasound for the placement of invasive lines.

6. Scholar

a) Exhibit dedication for continuing medical education including the use of online resources.

b) Be able to analyze cardiac anaesthesia related literature critically & demonstrate the fundamentals of research pertinent to this population.
c) Help to educate other members of the OR team.

7. Professional

a) Always exhibit courteous & empathetic attitude towards patients, their families & other health care providers.
b) Demonstrate respect for patients and colleagues by delivering the highest quality care to patients, practicing medicine ethically consistent with the obligations of a physician, respecting the opinions of fellow consultants and referring physicians in the management of patient problems, and be willing to provide means whereby differences of opinion can be discussed and resolved
c) Demonstrate an appropriate sense of responsibility to themselves and their patients
    a) Remain calm and organized in stressful or emergency situations
    b) Demonstrate appropriate interactions with colleagues and staff
    c) Show recognition of limits of personal skill and knowledge by appropriately consulting other physicians and paramedical personnel when caring for the patient

9. PEDIATRIC CARDIAC ANESTHESIA

Objective

To develop competences in anesthesia management of patients with cardiac disease scheduled for cardiac, non-cardiac surgical interventions, or other procedures.

Duration: Eight (8) blocks.

Outline of training: Subspecialty rotation in Year Two (F2)

Fellows are expected to become competent in the perioperative management of pediatric patients with cardiovascular diseases during this rotation.

1. Medical Expert

The fellow will demonstrate knowledge of the basic sciences as applied to the preoperative, intraoperative, and postoperative periods of cardiac surgery.

A. Physiology and Anatomy

The fellow is expected to:

a) Describe fetal circulation, development of the heart, and fetal physiology
b) Describe the different congenital cardiac anomalies and their surgical management
c) Describe single ventricle pathophysiology and specific management requirements
d) Describe the altered respiratory physiology of immediate postoperative cardiac cases
e) Describe common physiological changes occurring in the postoperative period and the impact they have on end-organ function (neurologic, renal, cardiac, hepatic, gastrointestinal)

B. Pharmacology

The fellow is expected to:

a) Compare common medications for cardiac surgical patients including anesthetic agents, vasodilators, vasoconstrictors, and inotropic agents
b) Explain the use of antifibrinolytic agents
c) Justify the use of blood products (packed red blood cells, fresh frozen plasma, platelets, cryoprecipitate), blood alternatives (e.g., albumin) and homeostasis stabilizing agents (desmopressin, activated factor VIIa)

C. Monitoring

The fellow will be able to:

- Interpret the electrocardiogram (ECG) for ischemia, infarction, arrhythmias, and paced rhythms
- Acquire skills of arterial and central venous cannulation (with ultrasound)
- Interpret central venous pressure and know the indications, complications, and management
- Know the basics of introductory transesophageal echocardiography (TEE), including techniques of probe insertion and several basic views, and implications and application in the critical care patient
- Know the significance of temperature management in the intraoperative period, including hypothermic techniques
- Understand the indicators of volume status, especially when weaning from bypass, including the findings from invasive monitors, TEE, and clinical indicators

D. Clinical Assessment and Management

The fellow will:

a) Know current indications and recommendations for sub-acute bacterial endocarditis prophylaxis
b) Be able to correct common derangements in metabolic and electrolyte disturbances in the intraoperative period
c) Know the basic principles of cardiac support devices, including the intra-aortic balloon pump and extracorporeal membrane oxygenation (ECMO)
d) Know the common pathophysiology and management of patients with:
    - Common congenital anomalies, e.g., atrial septal defect, ventricular septal defect, patent ductus arteriosus, tetralogy of Fallot
    - Complex congenital heart disease, e.g., transposition of the great vessels, truncus arteriosus, single ventricle physiology, abnormal pulmonary venous return
    - Heart transplant recipients
    - Palliative procedures: e.g., Norwood, bicavopulmonary anastomosis, Fontan
    - Obstructive lesions and pulmonary hypertension
    - Valvular heart disease for valve replacement or repair
    - Shock and the use of volume resuscitation, venodilators/constrictors, inotropes, and myocardial relaxants
    - Cardiac tamponade
    - Dilated, restrictive, or obstructive cardiomyopathy, congestive heart failure (CHF), and diastolic dysfunction
    - Aberrant conduction, dysrhythmia, sudden acute and subacute ventricular and supraventricular arrhythmia
    - Pacemakers and the indications for and applications of the various modes of temporary pacing
    - Pulmonary edema and CHF
    - Heparin-induced thrombocytopenia and heparin resistance
    - Neurologic risk stratification during cardiopulmonary bypass procedures

E. Special Topics Pertaining to Pediatric Cardiac Anesthesia

Pediatric Cardiovascular Physiology

- Fetal circulation
- Closure of the ductus arteriosus
- Closure of the foramen ovale
- Closure of the ductus venosus
- Pulmonary vascular changes
- Myocardial performance in the neonate

Pathophysiology of CHD

- The concept of shunting
- Classification of anatomic shunts
- Complex shunts
- Single ventricle physiology
- Intercirculatory mixing
- Pulmonary vascular pathophysiology and control
- Myocardial ischemia

Preoperative Evaluation and Preparation

- Psychological considerations
- History and examination
- Laboratory data interpretation
- Preoperative fluid therapy

- Preoperative medications

Monitoring Considerations

- ECG and blood pressure
- Arterial and CVP line challenges
- Temperature
- NIRS and transcranial Doppler
- TEE prop insertion

Anesthesia Management of ASD and VSD Closure

- Restricted or non-restricted shunt
- Direction of the shunt
- Balanced anesthesia
- Balanced pulmonary to systemic circulation
- Pulmonary hypertension crises
- Direct monitoring of the PAP
- Post-operative heart block

Anesthesia Management of Atrioventricular Canal Defects

- Balanced or imbalanced
- Induction and maintenance of anesthesia
- Post-CPB management

Anesthesia Management of PDA Closure

- Thoracotomy approach
- Post-operative pain management

Anesthesia Management of Coarctation of Aorta

- Severity of coarctation
- The type and severity of associated heart lesions
- Arterial line insertion challenges

Anesthesia Management of TOF

- Hypoxic and hyper-cyanotic episodes
- Preoperative optimization

Anesthesia Management of TGA

- Type of concordance
- Anatomy of the coronaries
- Emergency septostomy
- Prostin infusion
- Type of surgical intervention
- Palliative or therapeutic repair
- Post-CPB management
- Open or closed sternum

Anesthesia Management of Anomalous Pulmonary Venous Return

- Total or partial
- Intracardiac or extracardiac
- Pulmonary edema

Anesthesia Management of Single Ventricle Infant

- Left or right outflow obstruction
- PDA stenting vs ligation
- BT shunt
- Initial procedure to improve pulmonary blood flow
- Initial procedure to improve systemic blood flow
- Post-operative ventricular dysfunction
- Glenn or Fontan operation
- Fontan and Glenn complications

Deep Hypothermia Circulatory Arrest

- Indications
- Preparations
- Technique
- Complications

Anesthesia Management of Truncus Arteriosus

- Single ventricular physiology
- Bidirectional shunt
- Congestive heart failure

Anesthesia Management of Aortic and Pulmonary Valve Stenosis

Anesthesia Management of Multi-Staged Congenital Heart Disease

Anesthesia Management of Complete Heart Block for Pacemaker Implantation

Anesthesia Management of Heart and Lung Transplantations

2. Communicator

The fellow will be able to:

a) Demonstrate effective communication with patients and families (description of procedures, informed consent, anesthetic options, and risks)
b) Demonstrate effective communication with the OR team (cardiac surgeons, nurses, and perfusionists) and postoperative team, especially during the initiation and removal of cardiopulmonary bypass

3. Collaborator

The fellow will be able to:

a) Recognize the need to consult other specialists for the care and management of the critical patient
b) Foster healthy team relationships

4. Manager

The fellow will be able to:

a) Demonstrate efficient use of time regarding patient assessment, OR set-up, anesthesia induction, transfer to PACU or ICU, and OR turnover
b) Demonstrate the ability to make judgments regarding the cost-effective use of anesthesia resources with respect to drug choices, as well as monitoring and other equipment options

5. Health Advocate

The fellow will be able to:

a) Demonstrate knowledge and recognition of broad health and societal issues that affect anesthetic care of the pediatric cardiac patient
b) Demonstrate the use of risk reduction strategies, including use of ultrasound and sterile techniques for invasive lines

6. Scholar

The fellow will:

a) Demonstrate commitment to continuing personal education, including the use of information technology
b) Demonstrate ability to critically appraise current anesthesia literature and apply new knowledge based on appropriate evidence
c) Demonstrate effective teaching when assigned medical students or residents

7. Professional

The fellow will:

a) Always demonstrate respectful and compassionate behavior toward patients, their families, and other health care providers
b) Demonstrate the attitude, behavior, and ethical standards expected of a practitioner of anesthesia
c) Be aware of the ethical and legal aspects of the care of the pediatric cardiac patient
d) Recognize potential conflicts in patent care situations, professional relationships, and value systems, and demonstrate the ability to discuss and resolve differences of opinion

10. ADULT CARDIAC ICU (ACICU)

Duration

One (1) block, in the first year (F1).

During this rotation, the fellow will assess the patient and outline a course of therapy and investigation for a patient with a cardiac problem. The resident will understand the implications of the patient's disease in relation to any intervention.

1. Medical Expert

The Cardiac Anesthesiology Fellow(s) will understand the spectrum of critical surgical illness following cardiac, vascular, thoracic, or pulmonary procedures. In the course of following postoperative critically ill patient, the fellow(s) should know:

a) The anatomy, physiology, conduction, and metabolic activity in the normal heart and blood vessels
b) Be able to take a complete cardiovascular history, examination, and interpretation the investigation to diagnose the abnormal contractility or rhythm abnormality
c) Diagnosis, investigation, and management of patients with chest pain, heart failure, and shock, and discuss the current standards of cardiopulmonary resuscitation
d) The common heart and vascular diseases, e.g., coronary, valvular lesions, arterial and pulmonary hypertension
e) The indications for cardiac pacing, different types and modes of pacemakers
f) The fundamental principle and operation of single and bi-ventricular assist devices
g) Post-cardiac surgery renal failure work-up and management
h) Assessment and management work up of post-cardiac surgery coagulopathy
i) Be familiar with the following techniques and therapeutic procedures:
    - Electrocardiography exercise test
    - Holter monitoring
    - His bundle electrocardiography
    - Cardioversion
    - Techniques for insertion of perivenous and epicardial pacemakers
    - Echocardiography and transesophageal echocardiography (TEE)
    - Cardiac catheterization
    - Swan-Ganz catheterization
    - Intra-aortic balloon augmentation of cardiac output
    - Cardiopulmonary bypass
    - Percutaneous transluminal coronary angioplasty

j) Diagnosis and management of post-cardiac surgery low output state, and arrhythmia
k) Prevention, diagnosis, and management of ventilator-associated pneumonia
l) Indications for and maintenance/trouble-shooting IABP
m) Post-cardiac surgical patient with low cardiac count for cardiac tamponade, requiring urgent reopening
n) The management of post-cardiac surgical patient with myocardial ischemia
o) The post-cardiac surgical patient requiring acute airway management who also has a difficult airway
p) Differential diagnosis and appropriate treatment of postoperative confusion, agitation, and stroke
q) Parenteral nutrition
r) Appropriately provide sedation and analgesia to postoperative CSICU patients
s) Anticipate problems associated with transport of critically ill patients

2. Communicator

a) The fellow must be able to constructively liaise with the patients and their family with regards to all the aspects of their medical care. This comprises of being able to make the patient comfortable & acquiring all the essential information.
b) The fellow will be able to successfully liaise with other specialty services regarding post op cardiac patients.
c) The fellow will be able to discuss completely the management of patients and convey their issues & concerns verbally as well as in writing.
d) The fellow will know when consultation with other services is needed and expedient for the patient.
e) The fellow will register legibly & concisely all aspects of his/her involvement with the patient.

3. Collaborator

a) The fellow will endeavor to include other medical and allied health specialties whenever necessary to optimize the care of their patients
b) The fellow will exhibit respect, maturity, & professionalism while interacting with other physicians & health care professionals.

4. Manager

a) The fellow will judiciously manage their time so that all patients requiring deliberation can be seen.
b) The fellow will triage and categorize the patients on the basis of urgency of care.
c) The fellow will guide junior residents & medical students to the purpose as well as obtain supervision from the attending staff when required.
d) The fellow will assign certain tasks to other team members when deemed necessary.

5. Health Advocate

a) The fellow must always be an advocate for the rights of the patients especially when patient is incapacitated.
b) The fellow must always ascertain that excellence is sought in the patient care & all policies and guidelines are followed through.

6. Scholar

a) The fellow must continue with self-directed learning in order to improve their patient care.
b) The fellow must be able to evaluate critically the published literature in order to ensure that optimal management plans for their patients are arranged while ascertaining that his/her practice is evidence based.
c) The fellow will train more junior members of the team to purpose while establishing high standards of patient care.

7. Professional

a) The fellow will ascertain that he/she is aware of the obligations towards the patients & ensure proper handover to colleagues when he/she is not accessible.
b) The fellow will nurture the doctor patient relationship & keep all information confidential.
c) The fellow will exhibit apposite ethical acumen.
d) The fellow will remain composed, confident & efficient when working under stress.

11. PEDIATRIC INTENSIVE CARE

Objective

To develop competencies in managing ventilated and critically ill children with common congenital anomalies and postoperative care of pediatric cardiac patients

Total duration

One (1) block.

Outline of Training

Pediatric critical care rotation (NICU or PSICU) must be completed during the second year of fellowship

The fellow should understand the pathophysiology and management of common serious pediatric problems in the PSICU.

1. Medical Expert

a) Understand normal physiology and pathophysiology of major organ systems
b) Understand the roles and implications of aggressive care, palliative care, and code status decision
c) Demonstrate thorough knowledge of etiology, pathophysiology, clinical features, diagnosis, complications, management, prognosis, and prevention of common PSICU problems such as:
    - Cardiopulmonary failure and arrest
    - Respiratory failure
    - Septic shock and multiple organ dysfunction syndrome (MODS)
    - Nutrition: enteral and parenteral
    - Renal failure, and electrolyte and acid-base abnormalities
    - Hematologic dysfunction and blood product replacement therapy
    - Neurological emergencies: coma, status epilepticus, intracranial hypertension
    - Pain, anxiety, sedation
    - Brain death and organ donation
    - Toxicology
    - Polytrauma, traumatic brain injury, and burns

2. Communicator

a) Demonstrate rational means for collecting pertinent history from patients and their families in intensive care settings
b) Efficiently present patient problems, assessment, and treatment plan during rounds
c) Discuss diagnoses, investigations, and management options with patients and their families
d) Communicate and support patients and families confronted with critical illness
e) Be able to communicate bad news to families of children with critical illness

3. Collaborator

a) Recognize and respect the roles of allied healthcare professionals (physicians, nursing personnel, and supporting critical care personnel) in the management of critically ill patients
b) Demonstrate appropriate use of consultations
c) Work and communicate effectively in a team with other physicians and allied healthcare professionals to develop a care plan for the patient

4. Manager

a) Establish time handling skills to balance personal life, patient care & work practice.
b) Arrange & rank the care of multiple sick patients with co morbidities in order of importance.
c) Utilize the health care resources rationally.

5. Health Advocate

a) Identify opportunities for patient counseling and education regarding their medical condition
b) Understand and adapt patient assessment and management based on important determinants of health (psychosocial, economic, and biologic)

6. Scholar

a) Demonstrate the ability to generate clinical questions related to patient care
b) Critically appraise the literature regarding issues in critical care medicine
c) Utilize information technology to optimize patient care and life-long learning
d) Adapt variable teaching skills

7. Professional

a) Demonstrate professional attitudes, altruism, honesty, integrity, and respect in interactions with patients, families, and other healthcare professionals, or when facing ethical situations
b) Deliver high-quality care with integrity and compassion
d) Recognize and acknowledge personal emotional reactions and limitations in one's own knowledge, skills, and attitudes

12. CATH. LAB/ELECTRO-PHYSIOLOGY LAB AND OTHER REMOTE AREA ANESTHESIA

Objective

To develop competences in the anesthesia managements of cardiac patients who require diagnostic or interventional procedures in cardiac catheterization laboratory, electrophysiology laboratory, and other radiological departments.

Duration:

Three (3) blocks

Outline of training:

This should be done during Years One and Two. This is a three-month rotation during which fellows will be exposed to anesthesia and sedation practice outside the environment of the operating room.

1. Medical Expert/Clinical Decision Maker

The fellow will be able to:

a) Demonstrate location, patient, and procedure-specific knowledge of unique anesthesia considerations outside of the operating room
b) understand the challenges of the anesthesiologist:
   - Unfamiliar remote location
   - Exposure to radiation
   - Limited help from colleagues
   - Communication with cardiologist
c) Have adequate knowledge about the environment, personnel, fluoroscope, echocardiography, and type of radiocontrast dye during the procedure in catheterization laboratory
d) Understand the pros and cons of sedation versus general anesthesia for outlying procedures
e) Understand the principles of anesthesia practice in procedures including but not limited to:
   - Cath-lab, adult, and pediatric
   - Electrophysiology lab
   - Cardiac-magnetic resonance imaging (MRI)
   - Cardiac computed tomography (CT)
   - Echo department, especially TEE
   - Cardioversion in CCU
   - Angiography, ultrasound-guided biopsy
   - Radiation therapy
   - Dental, dermatologic, and bone marrow biopsies
   - Burn dressing
f) Conduct anesthesia in patients for diagnostic and palliative procedures in cardiology, radiology, and cath lab (outside operative rooms)
g) be involved in managing cardiology patients undergoing electrophysiology (EP) procedures such as ablation of abnormal conduction pathways, implantation of pacemakers and internal cardiac defibrillators, and laser lead extractions for pacemaker wires
h) Pay special consideration to the invasive cardiology procedures that can lead to major complications:
   - TAVI can lead to:
     i. Vascular injury
     ii. Migration of the valve
     iii. Arrhythmia
     vi. Obstruction
     v. Ischemia
     vi. Perforation and tamponading

- MV clipping
- ASD, VSD, PDA, device closure, and stenting
- TV and PV implantation

i) Manage anesthesia during emergency surgery and cases directly emerging from cath lab after cath lab complication
j) Know when he/she is requesting the procedure to be done in OR, if the remote area is not safe, or the patient is high-risk.

2. Communicator

The fellow will:

a) Communicate a succinct assessment and perioperative anesthetic management plan to attending staff
b) Clearly communicate specific requests and concerns to staff that may be requested by the anesthesia team
c) Communicate with the interventional cardiologist, cardiac surgeon, and perfusionist in case of high-risk patient or high-risk procedure

3. Collaborator

The fellow will:

a) Effectively consult with other health care professionals and demonstrate appropriate judgment regarding the assessment of cardiac anesthetic risk
b) Coordinate the care of cardiac patients with other health professionals in various departments
c) Demonstrate skill in managing crisis situations as a team member or team leader

4. Manager

The fellow will:

a) Demonstrate efficient use of time regarding patient assessment, OR set-up, anesthesia induction, and transfer to PACU or ICU, and OR turnover
b) Demonstrate awareness of the principles and priorities for patient scheduling

5. Scholar

The fellow will:

a) Demonstrate development, implementation, and monitoring of a personal continuing education strategy
b) Demonstrate effective teaching when assigned medical students or residents

6. Health Advocate

The fellow will:

a) Ensure proper equipment and personnel are available prior to starting the provision of anesthesia services
b) Understand the principles of and compliance with radiation safety for the patient and staff

7. Professional

The fellow will:

a) Deliver anesthesia care with integrity, honesty, and compassion
b) Demonstrate the attitude, behavior, and ethical standards expected of a practitioner of anesthesia

c) Be aware of the ethical and legal aspects of the care of the pediatric patient
d) Show recognition of personal limits through appropriate consultation with health professionals, and show appropriate respect for those consulted

13. TRANS-ESOPHAGEAL ECHOCARDIOGRAPHY (TEE)

Objective

To develop competencies in the management of cardiac patients requiring TEE evaluation during cardiac surgery.

Duration

Fellows will spend approximately two (2) blocks of dedicated time in the operating room completing TEE days. Training will be conducted mainly in the cardiac OR under the supervision of cardiac anesthesiologists.

1. Medical Expert

At the completion of this rotation, the fellow(s) will understand and be able to:

a) The basic principles of ultrasound and how it is incorporated into 2D echo, spectral, and color Doppler echocardiography
b) The difference and limitations between continuous and pulsed-wave Doppler ultrasound and their different applications
c) Basic cardiac anatomy and be able to recognize corresponding structures on a TEE examination
d) The indications, limitations, contraindications, and complications of TEE
e) Different artifacts that may interfere with reading an echocardiographic image (e.g., reverberations, side lobes, shadowing, and other artificial effects)
f) Properly and safely insert and manipulate a TEE probe into an anesthetized patient
g) Complete a basic TEE examination, including evaluation of left and right ventricle function, heart valves, the aorta, and regional wall motion abnormality
h) Discuss the indications, limitations, contraindications, and complications of TEE
i) Demonstrate the primary views used for intraoperative TEE to examine the heart and great vessels
j) Measure normal cardiac dimensions, area, and volume
k) Measure global systolic and diastolic function and recognize abnormal systolic and diastolic function
l) Recognize the different segments for regional wall motion analysis and the numeric scoring system
m) Understand and identify common congenital cardiac lesions, and describe embryologic origins of such lesions
n) Identify and quantify intracardiac shunts, both congenital and acquired
o) Understand cardiac implications of non-cardiac diseases as they pertain to ultrasonographically identifiable abnormalities
p) Understand advanced techniques for quantifying systolic function (circumferential shortening, index of myocardial performance, dp/dt relationships, etc.)
q) Understand advanced techniques for quantifying diastolic function (velocity of propagation, tissue Doppler analysis, isovolumic relaxation times, etc.)
r) Identify and describe diseases of the pericardium, including constrictive pericarditis and various manifestations of pericardial tamponade
s) Recognize abnormal cardiac function that requires immediate therapy
t) Assess the results of pharmacologic therapy on cardiac function
u) Evaluate the hemodynamic ally unstable patient, specifically:
    - Identify the typical 2D echocardiographic features of pericardial tamponade
    - Identify the typical 2D echocardiographic features of severe right and left ventricular dysfunction
    - Identify the typical 2D echocardiographic features of pulmonary embolus
    - Identify the typical 2D echocardiographic features of hypovolemia
    - Identify the typical 2D echocardiographic features of atrial and ventricular septal defects
v) Recognize when findings are beyond the fellow's expertise level and call for additional help.
    - Evaluation of the aortic valve

- Demonstrate the three primary views used for intraoperative assessment of the aortic valve
- Recognize the normal aortic valve leaflets morphology, velocities, area, and opening
- Calculate cardiac output based on aortic flow interrogation
- Perform a quantitative and qualitative assessment of aortic valve stenosis and regurgitant lesions
- Derive pressure gradients across the aortic valve based on Doppler-derived velocities.
- Differentiate aortic and sub-aortic stenosis
- Calculate the aortic valve area using planimetry and the continuity equation
- Be comfortable with at least three different methods of grading the severity of aortic insufficiency utilizing color flow Doppler and continuous Doppler
- Calculate regurgitant volume and fractions of aortic insufficiency
- Provide anatomical information necessary for surgical repair or replacement
- Accurately estimate aortic annular size for surgical replacement
- Accurately assess post-valve repair/replacement function
- Accurately assess need for re-intervention in above patients

- Evaluation of the mitral valve
  - Recognize the normal mitral valve leaflet morphology, velocities, area, and dynamic opening
  - Describe Carpenter's and Duran's nomenclature of the mitral valve apparatus
  - Recognize the typical 2D-echocardiographic features of mitral stenosis
  - Quantify mitral stenosis using continuity equation, proximal isovelocity surface area (PISA) method, and pressure half-time
  - Differentiate between restrictive leaflet motion, normal leaflet motion, and excessive leaflet motion as variants of mitral regurgitation
  - Critically assess mitral valve regurgitation by color flow-Doppler and PISA method
  - Calculate mitral regurgitant volume and fraction
  - Recognize normal and abnormal pulmonary venous flow patterns
  - Correctly identify severe mitral insufficiency by pulmonary vein flow
  - Identify restrictive physiology by pulmonary vein flow patterns
  - Provide surgeons with relevant, detailed systemic and functional information necessary for mitral valve repair or replacement
  - Accurately assess post-valve repair/replacement function
  - Accurately assess need for re-intervention in above patients
- Evaluation of the tricuspid and pulmonic valve
  - Recognize the normal tricuspid and pulmonic valve leaflets, velocities, area and opening
  - Recognize normal and abnormal tricuspid inflow patterns and hepatic venous patterns and the pathophysiological implications
  - Obtain intraoperative vena caval views to document cannula placement or to monitor tumor or air-embolic loads for particular surgical cases
  - Qualitatively and quantitatively evaluate tricuspid regurgitation
  - Accurately and reproducibly measure right ventricular systolic pressure
  - Qualitatively and quantitatively evaluate pulmonic stenosis and regurgitation
  - Provide surgeons with relevant information necessary for tricuspid valve repair or replacement
  - Provide surgeons with relevant information necessary for pulmonary valve repair or replacement
  - Accurately assess post-valve repair/replacement function
  - Accurately assess need for re-intervention in above patients
- Evaluation of the aorta
  - Learn the views used for intraoperative assessment of the ascending, arch, and descending aorta
  - Identify the typical 2D echocardiographic features of the various aortic dissections
  - Identify the typical 2D echocardiographic features of atheromatous plaque in the aorta, grade degree of atheromatous aortic disease

- Guide/identify proper IABP placement via echo assessment
- Basic topics covered in twice-monthly TEE conferences including but not limited to:
  - Basic principles of 2D echo
  - Basic principles of spectral and color Doppler
  - Basic cardiac anatomy and TEE
  - Global and regional LV and RV function
  - Basic and advanced evaluation of the aortic valve
  - Basic and advanced evaluation of the mitral valve
  - Basic and advanced evaluation of the tricuspid valve
  - Basic and advanced evaluation of the pulmonic valve
  - Evaluation of systolic and diastolic dysfunction
  - Evaluation of the aorta
  - Evaluation of the hemodynamically unstable patient
  - Indications, complications, and pitfalls of TEE

2. Communicator

a) Demonstrate appropriate communication skills between cardiac surgeon and cardiac anesthesiologist during open heart surgery
b) Demonstrate effective tools for gathering historical information from patients and their families in the critical care setting
c) Efficiently present patient problems, assessment, and treatment plan during rounds
d) Discuss diagnoses, investigations, and management options with patients and their families
e) Communicate and support patients and families confronted with critical illness
f) Be able to communicate bad news to families of children with critical illness

3. Collaborator

a) Recognize and respect the roles of allied healthcare professionals (physicians, nursing personnel, and supporting critical care personnel) in the management of critically ill patients
b) Demonstrate appropriate use of consultations
c) Work and communicate effectively in a team with other physicians and allied healthcare professionals to develop a care plan for the patient

4. Manager

a) Develop the expertise in handling the equipment in the shared specialties.
b) Prioritize the care of sick patients to ensure that their guardianship is not neglected.

5. Health Advocate

a) Identify opportunities for patient counseling and education regarding their medical condition
b) Understand and adapt patient assessment and management based on important determinants of health (psychosocial, economic, and biological)

6. Scholar

a) Demonstrate the ability to generate clinical questions related to patient care
b) Critically appraise the literature regarding issues in critical care medicine
c) Utilize information technology to optimize patient care and life-long learning
d) Adapt variable teaching skills

7. Professional

a) Demonstrate professional attitudes, altruism, honesty, integrity, and respect in interactions with patients, families, and other healthcare professionals, or when facing ethical situations
b) Deliver high-quality care with integrity and compassion
c) Recognize and acknowledge personal emotional reactions and limitations in one's own knowledge, skills, and attitudes

14. RESEARCH PROJECT

The purpose of this rotation will be to familiarize the fellow with scientific methodology and publication processes. The fellow will either initiate his/her own research project or will join a project already under way. The goal of this rotation will be to produce a piece of scientific work that can be presented at a major academic meeting.

Fellows must complete a project at the end of training, which can be any of the following, but not limited to:

- Adult cardiac anesthesia-related evidence-based policy and procedure
- Pediatric cardiac anesthesia-related evidence-based policy and procedure
- Perianesthesia monitoring goals and findings
- Hemodynamic goal-directed therapy
- Protective mechanical ventilation during cardiac surgery
- Hemostasis strategies during and post-operative cardiac surgery
- Cardiopulmonary mechanical support innovation
- Case report
- Article review
- Qualitative or quantitative research project
- Cardiac tumors

15. LEARNING PORTFOLIO, WORKSHOPS, AND COURSES

1. Log Book

a) Fellows are expected to document all cases and procedures completed in a log book to be presented at the end of each academic year.
b) The recommended minimum number of procedures to achieve skills development is forty (40) each of adult and pediatric cases. Such procedural skills include invasive lines, neonatal intubations, and TEE.
c) A minimum of one hundred forty (140) logged cases registered during the two-year training program is required as following:
   - Forty (40) adult surgical cardiac cases
   - Forty (40) pediatric surgical cardiac cases
   - Twenty (20) adult and pediatric Cath-Lab cases
   - Ten (10) electrophysiology lab cases
   - Ten (10) cardiac MRI cases
   - Ten (10) CT-Angio patient cases
   - Ten (10) TEE cases
d) Feedback by the program director will be given to the fellows at the end of each academic year and instructions will be given to fulfill deficient procedures.

Logbook for Cardiac Anesthesia Fellowship Program	
First Year	
Type of Cases	**Number of Cases**
Adult Cardiac Surgery	**40**
Cath Laboratory	**5**
Electrophysiology Laboratory	**5**
Cardiac MRI	**5**
Cardiac CT-Angio	**5**
TEE	**5**
Second Year	
Pediatric Cardiac Surgery	**40**
Cath Laboratory	**5**
Electrophysiology Laboratory	**5**
Cardiac MRI	**5**
Cardiac CT-Angio	**5**
TEE	**5**
Total	**140**

2. Workshops and Courses

i) Pediatric Advanced Life Support (PALS) (Mandatory)
ii) Advance Cardiac Life Support (ACLS) (Mandatory)
iii) Airway Management Workshop (Mandatory)
vi) Ultrasound Guided Vascular Access in Adult/Pediatric Patients (Recommended)
v) Extracorporeal Life Support Workshop (Recommended)

vi) Transesophageal Echocardiography Course (Recommended)
vii) Crisis Resource Management (Recommended)

3. Pediatric Life Support (PALS)

By the end of this course, the candidate should demonstrate a systematic approach in the management of critically ill children:

a) Be able to recognize patients who require frequent monitoring and earlier intervention
b) Effectively work as a team member
c) Systematically manage the patients after cardiac arrest

CanMED Competencies

The following CanMED competencies will be covered during the course: Medical Expert, Communicator, Collaborator, and Professional

4. Advanced Cardiac Life Support (ACLS)

By the end of this course, the candidate should be able to demonstrate:

a) Basic life support skills including effective chest compressions, use of bag mask device, and use of automated electrical defibrillator (AED)
b) Recognize and initiate early management of respiratory and cardiac arrest
c) To recognize and manage peri-arrest conditions
d) Manage acute coronary syndrome and stroke
e) Effectively communicate as a member and as a leader of resuscitation team

CanMED Competencies

The following CanMED competencies will be covered during the course: Medical Expert, Communicator, Collaborator, Leader, and Professional

5. Airway Management Workshop

By the end of this course, the candidate should be able to:

a) Discuss the difficult airway algorithm available for adult and pediatric populations
b) Practice airway management with different commercially available tools under the guidance of experts
c) Demonstrate the handling and care of flexible fiberoptic bronchoscopes
d) Demonstrate the skills for emergent invasive airway access with commercially available tools
e) Apply the algorithm to different clinical scenarios using high to low-fidelity simulators

CanMED Competencies

The following CanMED competencies will be covered during the course: Medical Expert, Communicator, Collaborator, Leader, and Professional.

6. Ultrasound-Guided Vascular Access Workshop

By the end of this course, the candidate should be able to demonstrate:

a) The anatomical relationship of vascular structures and their sonographic appearance in the upper limb, lower limb, neck and thoracic region
b) The steps in performing the vascular cannulation for arterial and venous access
c) The framework of Integrating point of care ultrasound in the care of patients

CanMED Competencies

The following CanMED competencies will be covered during the course: Medical Expert, Communicator, Collaborator, and Professional.

7. Transesophageal Echocardiography Workshop/Course

By the end of this course/workshop, the candidate should be able to demonstrate:

a) The detailed anatomy of the heart, coronary arteries, and heart valves
b) Overview of the physics and basic modes of ultrasound, and how to optimize the images
c) Basic hemodynamic states, 2D and color flow Doppler modalities
d) Evaluate the structures adjacent to heart, e.g., pericardium and pleura

CanMED Competencies

The following CanMED competencies will be covered during the course: Medical Expert, Communicator, Collaborator, and Professional

8. Extracorporeal Life Support/Cardiopulmonary Bypass Workshop

By the end of this course, the candidate should be able to perform:

a) The care of patients with severe respiratory or cardiac failure requiring ECMO or cardiopulmonary bypass for complex cardiac surgeries
b) Cannulation techniques, access, initiation of support, patient and circuit physiology, and programmatic design and management
c) Decision-making regarding the pump flow to optimize O_2 delivery and O_2 consumption
d) Weaning protocols for cardiopulmonary bypass/ECMO
e) Fluid balance, hemodilution management, and usefulness of features employed with cardiopulmonary bypass, e.g., ultrafiltration

CanMED Competencies

The following CanMED competencies will be covered during the course: Medical Expert, Communicator, Collaborator, and Professional

9. Crisis Resource Management (CRM)

By the end of the interactive workshop, the candidate should be able to:

a) Define an adverse event/crisis
b) Challenge their technical and theoretical knowledge during simulation, and demonstrate their ability to recognize and treat realistic and complex perioperative situations
c) Discuss reasons for susceptibility of anesthesia practice to crisis
d) Manage critical hemodynamic and respiratory events with up-to-date techniques in a safe learning environment
e) Be introduced to the 15 elements of Anesthesia Crisis Resource Management
f) Reflect on their role in approaching leadership and effective communication within highly interactive small group debriefing sessions, which are held in strict confidence

CanMEDS Competencies

The following CanMED competencies will be covered during this workshop: Medical Expert, Communicator, Collaborator, and Professional

The teaching process in postgraduate cardiac anesthesia training programs is based mainly on the principles of adult learning theory. The trainees feel the importance of learning and taking active roles in the content and the process of their own learning. The training programs implement

the appropriate adult learning concept for each feature of the activities where the residents are responsible for their own learning requirements.

10. List of Topics to be Covered in Practice-Based Learning

a) Morbidity and Mortality Meetings, every month
b) Grand Rounds / Guest Speakers. During ICU rotation, every week
c) Journal Club and Critical Appraisal, every week
d) Evidence-Based Medicine, every month

11. Morbidity and Mortality Meetings

a) Recognize areas of refinement for clinicians involved in case management.
b) Avert errors that result into complications.
c) Reform the decision & behavior on the basis of previous experience.
d) Point out system related issues which may effect the patient care such as redundant policies & complicated patient identification procedures.

The CanMED competencies include Medical Expert, Manager, and Professional

12. Grand Round/Guest Speaker

a) Increase the physician's medical proficiency, expertise and eventually improve the patient care.
b) Understand and apply recent practice guidelines in the field of cardiac anaesthesia.
c) Discuss the new advancements in the field of cardiac anaesthesia.
d) Identify and elucidate the controversial areas in the field of cardiac anaesthesia.

The CanMED competencies include Medical Expert and Professional

13. Journal Club and Critical Appraisal

a) Promote continuing professional development
b) Keeping up to date with the literature
c) Disseminating information on and building debates about good practice
d) Ensuring that professional practice is evidence-based
e) Learning and practicing critical appraisal skills
f) Providing an enjoyable educational and social occasion

The CanMED competencies include Medical Expert, Scholar, and Health Advocate

14. Research and Evidence-Based Practice

a) Evolve a thorough understanding in research design, ethics, abstract writing & presentation skills.
b) Acquire proficiency in data analysis, interpretation & literature review.
c) Formulate a workable research proposal under the guidance of faculty mentor.
d) Conduct research on a topic broadly related to cardiac anesthesia
e) Communicate the research findings through oral, poster, abstract presentations or article publication.

The CanMED competencies include Scholar, Manager, and Professional

16. ASSESSMENT OF LEARNING

1. Purpose of Assessment

Assessment plays a vital role in the success of postgraduate training. Assessment will guide trainees and trainers to achieve the targeted learning objectives. On the other hand, reliable and valid assessment will provide excellent means for training improvement, as it will inform the following aspects: curriculum development, teaching methods, and quality of learning environment. Assessment can serve the following purposes:

a) **Assessment for learning**: As trainers will use information from trainees' performance to inform their learning for improvement.
b) **Assessment as learning**: As assessment criteria will drive trainees' learning.
c) **Assessment of learning**: As assessment outcomes will represent a quality metrics that can improve learning experience.

For the sake of organization, assessment will be further classified into two main categories: *Formative* and *Summative*.

2. Formative Assessment

2.1 General Principles

Trainees, as adult learners, should strive for feedback throughout their journey of competency from "novice" to "mastery" levels. *Formative assessment* (also referred to as continuous assessment) is the component of assessment that is distributed throughout the academic year, aiming primarily to provide trainees with effective feedback. Input from the overall formative assessment tools will be utilized at the end of the year to make the decision of promoting each individual trainee from current-to-subsequent training level. Formative assessment will be defined based on the Scientific (Council/Committee) recommendations (usually updated and announced for each individual program at the start of the academic year). According to the executive policy on continuous assessment (available online: www.scfhs.org), formative assessment will have the following features:

a) Multisource: a minimum of four tools.
b) Comprehensive: covering all learning domains (knowledge, skills, and attitude).
c) Relevant: focusing on workplace-based observations.
d) Competency-milestone oriented: reflecting expected competencies at the trainee's developmental level.

Trainees should play an active role in seeking feedback during their training. Conversely, trainers are expected to provide timely and formative assessment. SCFHS will provide an e-portfolio system to enhance communication and analysis of data arising from formative assessment.

Trainers and trainees are directed to follow the recommendations of the scientific council regarding the updated forms, frequency, distribution, and deadlines related to the implementation of evaluation forms.

2.2 Formative Assessment Tools

Learning Domain	Formative Assessment Tools	Frequency
Knowledge	- Structured Oral Exam (SOE) - Annual Written Progress Test (Local or International) - Structured Academic Activates	**At the End of Second Year** **At the End of First and Second Years**

	- Case Based Discussion (CBD)	**Every Three Months** **Once per Week**
Skills	- OSCE: Objective Structured Clinical Examination	**At the End of Second Year**
	- Log Book	**At the End of First and Second Years**
	- DOPS: Direct Observation for Procedural Skills	**Every Month**
	- Mini-CEX: Mini-Clinical Evaluation Exercise	**Every Six Months**
	- Research Activities	**Once per Academic Year**
Attitude	- ITER: In-Training Evaluation Report	**Every Three Months**

The evaluation of each component will be based on the following equation:

Percentage	< 50%	50–59.4%	60–69.4%	> 70%
Description	Clear fail	Borderline fail	Borderline pass	Clear pass

To achieve unconditioned promotion, the candidate must score a minimum of "borderline pass" in all five components.

- The program director can still recommend the promotion of candidates if the above is not met in some situations:
- In case the candidate scored "borderline failure" in one or two components at maximum, and these scores should not belong to the same area of assessment (for example: both borderline failures should not belong to skills)
- The candidate must have passed all other components and scored a minimum of clear pass in at least two components.

3. Summative Assessment

3.1 General Principles

Summative assessment is the component of assessment that aims primarily to make informed decisions on trainees' competency. In comparison to the formative, *summative assessment* does not aim to provide constructive feedback. For further details on this section, please refer to general bylaws and executive policy of assessment (available online: www.scfhs.org). In order to be eligible to sit for the final exams, a trainee should be granted the Certification of Training Completion.

3.2 Blueprint Outlines

The content of the following table is for demonstration only; please refer to the most updated version published on SCFHS website.

A blueprint of the first part of the exam is shown in the following table:

Example of Written Exam Blueprint

Contents						
Categories	Sections	Proportions	Medical science	Diagnosis	Management	Investigations
Adult Cardiac Anesthesia 25%	**Ischemic Heart Disease**	% **5%**	**1**	**1**	**2**	**1**
	Valvular Disease	**5%**	**1**	**1**	**2**	**1**
	Major Vascular Disease	**5%**	**1**	**1**	**2**	**1**
	Cardiac and Lung Transplantation	**5%**	**1**	**1**	**2**	**1**
	Adult Congenital Cardiac Disease	**5%**	**1**	**1**	**2**	**1**
Cardiac Pharmacology 6%	**Cardiac Pharmacology**	**6%**	**3**	**0**	**3**	**0**
Cardiac Physiology 6%	**Cardiac Physiology**	**6%**	**3**	**0**	**3**	**0**
Pediatric Cardiac 10%	**Pediatric Cardiac**	**10%**	**3**	**2**	**3**	**2**
Interventional Cardiology 4%	**Interventional Cardiology**	**4%**	**1**	**1**	**1**	**1**
Monitoring +TEE 14%	**Monitoring +TEE**	**14%**	**5**	**3**	**3**	**3**
ICU 9%	**Adult and Pediatric ICU**	**9%**	**2**	**2**	**3**	**2**
Hemostasis 9%	**Hemostasis**	**9%**	**3**	**2**	**2**	**2**
Cardiac for non-Cardiac Procedures 9%	**Cardiac for Non-Cardiac Procedures**	**9%**	**2**	**2**	**3**	**2**
Scholarly Activities and others 10%	Research, ethics, professionalism, and patient safety	**8%**	**4**	**0**	**4**	**0**
	Total	100%				

3.3 Certification of Training Completion

In order to be eligible to set for final specialty examinations, each trainee is required to obtain the Certification of Training Completion. Based on the training bylaws and executive policy (please refer to www.scfhs.org), trainees will be granted the Certification of Training Completion once the following criteria are fulfilled:

a. Successful completion of all training rotations.
b. Completion of training requirements as outlined by the scientific council/committee of the respective specialty (e.g., logbook, research, others).
c. Clearance from SCFHS training affairs to ensure compliance with tuition payment and completion of universal topics.

The Certification of Training Completion will be issued and approved by the Supervisory Committee or its equivalent according to SCFHS policies.

3.4 Final Specialty Examinations

Learning Domain	Summative Assessment Tools	Passing Score
Knowledge	– Final Written Examination / end of second year	At least borderline pass in each tool in accordance with the standard-setting method used by the executive administration of assessment
Skills	– Structured Oral Examinations (SOE) / end of first and second years	At least borderline pass in each tool in accordance with the standard-setting method used by the executive administration of assessment
Attitude	FITER: In-Training Evaluation Report / 3 months	Successfully pass FITER

The final specialty examination is the summative assessment component that grants trainees the specialty certification. It has two elements:

a) Final written exam: In order to be eligible for this exam, trainees are required to have been awarded the Certification of Training Completion.
b) Final clinical/practical exam: Trainees will be required to pass the final written exam in order to be eligible to sit for the final clinical/practical exam.

Blueprint Outlines: The content of the following table is for demonstration only; please refer to the most recent version published on the SCFHS website.

Blueprints of the final written and clinical/practical exams are shown in the following table:

Example of Final Clinical Exam Blueprint

		DIMENSIONS OF CARE				
		Health Promotion and Illness Prevention 1±1 Station(s)	Adult Cardiac 1±1 Station(s)	Pediatric Cardiac 1±1 Station(s)	**Cardiac for Non-Cardiac** 1±1 Station(s)	**# Station(s)**
DOMAINS FOR INTEGRATED CLINICAL ENCOUNTER	**Patient Care** 4±1 Station(s)	**1**	**1**	**1**	**1**	**4**
	Patient Safety and Procedural Skills 0±1 Station(s)					
	Communication and Interpersonal Skills 0±1 Station(s)					
	Professional Behaviors					**0**

	0±1 Station(s)					

	Total Stations	**1**	**1**	**1**	**1**	**4**

*Main blueprint framework adapted from Medical Council of Canada Blueprint Project

For further details on final exams, please refer to general bylaws and executive policy of assessment (available online: www.scfhs.org).

17. REFERENCES

- *Cardiac Anesthesiology Fellow's Manual*. By P. Jason Toppin, Annette Vegas, MD. 7th Edition.
- *Kaplan's Cardiac Anesthesia*. By Joel A. Kaplan, MD. 7th Edition.
- *Anesthesia for Cardiac Surgery*. By James A. DiNardo, David A. Zvara, MD. 3rd Edition.
- *A Practical Approach to Cardiac Anesthesia*. By Frederick A. Hensley Jr., MD. 4th Edition.
- *Anesthesia for Congenital Heart Disease*. By Dean B. Andropoulos, Stephen A. Stayer, Isobel A. Russell. 3rd Edition.
- General major anesthesia textbooks, such as Miller and Barash.
- *Practical Approach to Transesophageal Echocardiography*. By Albert C. Perrino Jr., Scott T. Reeves. 3rd Edition
- Any reputable journal of anesthesia, such as *Anesthesiology, British Journal of Anaethesia,* and *Canadian Journal of Anesthesia.*
- (Frank JR, Snell L, Sherbino J, editors. *CanMEDS 2015 Physician Competency Framework.* Ottawa: Royal College of Physicians and Surgeons of Canada; 2015)
- *https://www.acgme.org/Portals/0/MilestonesGuidebook.pdf*

18. APPENDICES

Log Book

Logbook for Cardiac Anesthesia Fellowship Program								
No.	DATE	MRN	AGE	WT	ASA	PROCEDURE	TEE FINDING	COMMENTS

In-Training Daily Evaluation Form

Saudi Commission
For Health Specialties

الهيئة السعودية
للتخصصات الصحية

Fellow's Daily Evaluation Form

Name	_____					**Level**	☐ F1	☐ F2	
Day	☐ Sun	☐ Mon	☐ Tue	☐ Wed	☐ Thu	**Date**	_____	Room	_____

General Eval	1 = ☐ Unsatisfactory	2 = ☐ Below Average	3 = ☐ Average
	4 = ☐ Above Average	5 = ☐ Outstanding	N/A = ☐ Not Assessed

MEDICAL EXPERT						
1. Preparative Assessment & Planning	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ N/A
2. Appropriate Conduct of Anesthetic Plan	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ N/A
COMMUNICATOR						
3. Appropriate Communication Skills	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ N/A
4. Adequate Completion of Anesthetic Record	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ N/A
COLLABORATOR						
5. Appropriate Consultation	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ N/A
6. Ability to Work in Team	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ N/A
MANAGER						
7. Effective Management of OR Day	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ N/A
8. Effective Function in Emergency Situation	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ N/A
SCHOLAR						
9. Appropriate Knowledge of the Level of Training	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ N/A
10. Adequate Practical Skills for the Level of Training	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ N/A
HEALTH ADVOCATE						
11. Address Patient & OR Personnel's Safety	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ N/A
PROFESSIONAL						
12. Function Ethically & Compassionately	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ N/A
13. Punctual & Reliable	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ N/A

COMMENTS:

_____

_____

Evaluator	_____	**Signature**	_____

Fellow's End Of Rotation Evaluation

Saudi Commission
For Health Specialties

الهيئة السعودية
للتخصصات الصحية

Fellow's End of Rotation Evaluation

Name	:	_____	Hospital	:	_____	Reg #	:	_____
Rotation	:	_____	Start	:	_____	End	:	_____
Level	:	☐ F1			☐ F2			

#	CRITERIA	(<5) Unsatisfactory	(5-<6) Below Average	(6-7) Average	(>7-<9) Above Average	(9-10) Outstanding	N/A
A	**MEDICAL EXPERT**						
1.	Demonstrate knowledge for patient care						
2.	Demonstrate technical competence in operative procedures						
B	**COMMUNICATOR**						
3.	Establish an effective relationship with patients and families						
4.	Discuss appropriate information with patients and families and other members of the healthcare team						
5.	Age-appropriate involvement of children in anesthetic care						
C	**COLLABORATOR**						
6.	Consult with other physicians and health care professionals as appropriate						
7.	Contribute effectively to multidisciplinary team discussion and plan of execution						
D	**MANAGER**						
8.	Display managerial skills and guidance where appropriate						
9.	Allocate finite health care resources wisely						
10.	Utilize information technology to optimize patient care and lifelong learning						
E	**HEALTH ADVOCATE**						
11.	Recognize and respond to issues where advocacy is appropriate						
12.	Contribute effectively to improved health of patients and communities						
F	**PROFESSIONAL**						
13.	Critically appraise sources of medical information						
14.	Facilitate learning of patients, students, and other health professional						
15.	Contribute to the development of new knowledge						
F	**SCHOLAR**						
16.	Deliver highest quality care with integrity, honesty, and compassion						
17.	Practice medicine ethically consistent with the obligations of a physician						
18.	Be oriented to by-laws and regulation of national medical practice						

Total Score	Total Score / # Evaluated Items X 10 = 00.00%	:	____%
Comments:			

Evaluator	:		**Signature**	:	_____	**Date**	:	_____
Director	:		**Signature**	:	_____	**Date**	:	_____
Fellow	:		**Signature**	:	_____	**Date**	:	_____

Assessment of Progress

Assessment Method Decode	
A	Anesthesia Clinical Evaluation Exercise [A-CEX]
C	Case-Based Discussion [CBD]
D	Direct Observation of Procedural Skills [DOPS]
E	Examination
I	Intensive Care Medicine Clinical Evaluation Exercise [I-CEX]
L	Anesthesia List Management Assessment Tool [ALMAT]
M	Multi-Source Feedback [MSF]
T	Acute Care Assessment Tool [ACAT]
Good Medical Practice Decode	
1	Knowledge, Skills, and Performance
2	Safety and Quality
3	Communication, Partnership, and Teamwork
4	Maintaining Trust

1. Universal Topics

Intent:

These are high-value, interdisciplinary topics of outmost importance to the trainee. The reason for delivering the topics centrally is to ensure that every trainee receives high-quality teaching and develops essential core knowledge. These topics are common to all specialties and required for all fellows who are not certified by the Saudi Board of Anesthesia.

At least 12 Universal Topics are required during the whole period of training.

Topics included here meet one or more of the following criteria:

a) Impactful: These are topics that are common or life-threatening
b) Interdisciplinary: Topics that are difficult to teach in a single discipline
c) Orphan: Topics that are poorly represented in the undergraduate curriculum
d) Practical: Topics that trainees will encounter in hospital practice

Development and Delivery

These topics, which will be developed and delivered centrally by the Commission through an e-learning platform, are didactic in nature with a focus on practical aspects of care. These topics will be more content-heavy than workshops and other planned face-to-face interactive sessions. The suggested duration of each topic is 1 hour 30 minutes.

Assessment

The topics will be delivered in a modular fashion. At the end of each Learning Unit there will be an on-line formative assessment. After the completion of all topics, there will be a combined summative assessment in the form of a context-rich MCQ. All trainees must attain minimum competency in the summative assessment. Alternatively, these topics can be assessed in a summative manner along with a specialty examination.

Module 1: Introduction

a) Safe drug prescribing
b) Hospital-acquired infections
c) Sepsis; SIRS; DIVC
d) Antibiotic stewardship
e) Blood transfusion

Safe Drug Prescribing

At the end of the Learning Unit, you should be able to**:**

a) Recognize importance of safe drug prescribing in healthcare
b) Describe the various adverse drug reactions with examples of commonly prescribed drugs that can cause such reactions
c) Apply principles of drug-drug interactions, drug-disease interactions, and drug-food interactions in common situations
d) Apply principles of prescribing drugs in special situations such as renal failure and liver failure
e) Apply principles of prescribing drugs in elderly and pediatric age-group patents, and in pregnancy and lactation
f) Promote evidence-based cost-effective prescribing
g) Discuss the ethical and legal framework governing safe-drug prescribing in Saudi Arabia

Hospital-Acquired Infections (HAI)

At the end of the Learning Unit, you should be able to:

a) Discuss the epidemiology of HAI with special reference to HAI in Saudi Arabia
b) Recognize HAI as one of the major emerging threats in healthcare
c) Identify the common sources and set-ups of HAI
d) Describe the risk factors of common HAIs such as ventilator-associated pneumonia, MRSA, CLABSI, and vancomycin-resistant enterococcus (VRE)
e) Identify the role of healthcare workers in the prevention of HAI
f) Determine appropriate pharmacological (e.g., selected antibiotic) and non-pharmacological (e.g., removal of indwelling catheter) measures in the treatment of HAI
g) Propose a plan to prevent HAI in the workplace

Sepsis, SIRS, DIVC

At the end of the Learning Unit, you should be able to:

a) Explain the pathogenesis of sepsis, SIRS, and DIVC
b) Identify patient-related and non-patient-related predisposing factors of sepsis, SIRS, and DIVC
c) Recognize a patient at risk of developing sepsis, SIRS, and DIVC
d) Describe the complications of sepsis, SIRS, and DIVC
e) Apply the principles of management of patients with sepsis, SIRS, and DIVC
f) Describe the prognosis of sepsis, SIRS, and DIVC

Antibiotic Stewardship

At the end of the Learning Unit, you should be able to:

a) Recognize antibiotic resistance as one of the most pressing public health threats globally
b) Describe the mechanism of antibiotic resistance
c) Determine the appropriate and inappropriate use of antibiotics
d) Develop a plan for a safe and proper antibiotic usage plan including right indications, duration, types of antibiotic, and discontinuation.
e) Appraise of the local guidelines in the prevention of antibiotic resistance

Blood Transfusion

At the end of the Learning Unit, you should be able to:

a) Review the different components of blood products available for transfusion
b) Recognize the indications and contraindications of blood product transfusion
c) Discuss the benefits, risks, and alternatives to transfusion
d) Undertake consent for specific blood product transfusion
e) Perform steps necessary for safe transfusion
f) Develop understanding of special precautions and procedures necessary during massive transfusions
g) Recognize transfusion-associated reactions and provide immediate management

Module 2: Diabetes and Metabolic Disorders

Recognition and management of diabetic emergencies

a) Management of diabetic complications
b) Comorbidities of obesity
c) Abnormal ECG

Recognition and Management of Diabetic Emergencies

At the end of the Learning Unit, you should be able to:

a) Describe the pathogenesis of common diabetic emergencies including their complications
b) Identify risk factors and groups of patients vulnerable to such emergencies
c) Recognize patients presenting with diabetic emergencies
d) Institute immediate management
e) Refer the patient to appropriate next level of care
f) Counsel patient and families to prevent such emergencies

Management of Diabetic Complications

At the end of the Learning Unit, you should be able to:

a) Describe the pathogenesis of important complications of Type 2 diabetes mellitus
b) Screen patients for such complications
c) Provide preventive measures for such complications
d) Treat such complications
e) Counsel patients and families with special emphasis on prevention

Comorbidities of Obesity

At the end of the Learning Unit, you should be able to:

a) Screen patients for presence of common and important comorbidities of obesity
b) Manage obesity-related comorbidities
c) Provide dietary and life-style advice for prevention and management of obesity

Abnormal ECG:

At the end of the Learning Unit, you should be able to:

a) Recognize common and important ECG abnormalities
b) Institute immediate management, if necessary

Module 5: Acute Care

A. Preoperative assessment
B. Postoperative care
C. Acute pain management
D. Chronic pain management
E. Management of fluid in the hospitalized patient
F. Management of electrolyte imbalances

Preoperative Assessment

Upon completion of the learning unit, the trainee should be able to do the following:

a) Describe the basic principles of preoperative assessment
b) Preform preoperative assessment of uncomplicated patients, with particular emphasis on the following:
    - General health assessment
    - Cardiorespiratory assessment
    - Medication and medical device assessment
    - Drug allergy
    - Pain relief requirements

Postoperative Care

Upon completion of the learning unit, the trainee should be able to do the following:

a) Devise a postoperative care plan that includes monitoring vital signs, pain management, fluid management, medication, and laboratory investigations
b) Describe the process of postoperative recovery
c) Identify common postoperative complications
d) Monitor patients for possible postoperative complications
e) Institute immediate management of postoperative complications

Acute Pain Management

Upon completion of the learning unit, the trainee should be able to do the following:

a) Review the physiological basis of pain perception
b) Proactively identify patients in acute pain
c) Assess patients with acute pain
d) Apply the various pharmacological and nonpharmacological modalities available for acute pain management
e) Provide adequate pain relief for uncomplicated patients with acute pain
f) Identify and refer patients with acute pain who could benefit from specialized pain services

Chronic Pain Management

Upon completion of the learning unit, the trainee should be able to do the following:

a) Review the biopsychosocial and physiological bases of chronic pain perception
b) Discuss the various pharmacological and nonpharmacological options available for chronic pain management
c) Provide adequate pain relief for uncomplicated patients with chronic pain
d) Identify and refer patients with chronic pain who could benefit from specialized pain services

Management of Fluid in Hospitalized Patients

Upon completion of the learning unit, the trainee should be able to do the following:

a) Review the physiological basis of water balance in the body
b) Assess the patient's hydration status
c) Recognize patients with over- or underhydration
d) Order fluid therapy (oral and intravenous) for hospitalized patients
e) Monitor fluid status and response to therapy via history, physical examination, and selected laboratory investigations

Management of Acid-Base Electrolyte Imbalances

Upon completion of the learning unit, the trainee should be able to do the following:

a) Review the physiological basis of electrolyte and acid-base balance in the body
b) Identify diseases and conditions that are associated with or likely to cause acid-base and electrolyte imbalances
c) Correct electrolyte and acid-base imbalances
d) Perform careful calculations, checks, and other safety measures while correcting acid-base and electrolyte imbalances
e) Monitor response to therapy through history, physical examination, and selected laboratory investigations

Module 7: Ethics and Healthcare

1 Occupational hazards of HCW
2 Evidence-based approach to smoking cessation
3 Patient advocacy
4 Ethical issues: transplantation/organ harvesting; withdrawal of care
5 Ethical issues: treatment refusal; patient autonomy
6 Role of doctors in death and dying

Occupational Hazards of Health Care Workers (HCWs)

At the end of the Learning Unit, you should be able to:

a) Recognize common sources and risk factors of occupational hazards among HCWs
b) Describe common occupational hazards in the workplace
c) Develop familiarity with legal and regulatory frameworks governing occupational hazards among HCWs
d) Develop a proactive attitude to promote workplace safety
e) Protect yourself and colleagues against potential occupational hazards in the workplace

Evidence-Based Approach to Smoking Cessation

At the end of the Learning Unit, you should be able to:

a) Describe the epidemiology of smoking and tobacco usage in Saudi Arabia
b) Review the effects of smoking on the smoker and family members
c) Effectively use pharmacological and non-pharmacological measures to treat tobacco usage and dependence
e) Effectively use pharmacological and non-pharmacological measures to treat tobacco usage and dependence among special population groups such as pregnant women, adolescents, and patients with psychiatric disorders

Patient Advocacy

At the end of the Learning Unit, you should be able to:

a) Define patient advocacy
b) Recognize patient advocacy as a core value governing medical practice
c) Describe the role of patient advocates in the care of the patients
d) Develop a positive attitude toward patient advocacy
e) Be a patient advocate in situations of conflict
f) Be familiar with local and national patient advocacy groups

Ethical Issues: Transplantation/Organ Harvesting; Withdrawal of Care

At the end of the Learning Unit, you should be able to:

a) Apply key ethical and religious principles governing organ transplantation and withdrawal of care
b) Be familiar with the legal and regulatory guidelines regarding organ transplantation and withdrawal of care
c) Counsel patients and families in the light of applicable ethical and religious principles
d) Guide patients and families to make informed decision

Ethical Issues: Treatment Refusal; Patient Autonomy

At the end of the Learning Unit, you should be able to:

a) Predict situations where a patient or family is likely to decline prescribed treatment
b) Describe the concept of "rational adult in the context of patient autonomy and treatment refusal
c) Analyze key ethical, moral, and regulatory dilemmas in treatment refusal
d) Recognize the importance of patient autonomy in the decision-making process
e) Counsel patients and families declining medical treatment in the light of the best interest of patients

Role of Doctors in Death and Dying

At the end of the Learning Unit, you should be able to:

a) Recognize the important role a doctor can play during a dying process
b) Provide emotional as well as physical care to a dying patient and family
c) Provide appropriate pain management for a dying patient
d) Identify suitable patients and refer the patient to palliative care services

2. Adult Cardiac Anesthesia Topics/Skills Checklist

Anatomy and Physiology of the Adult Cardiovascular System

By the end of the interactive lecture, the fellow will be able to:

- Describe the normal coronary anatomy and variants, normal cardiac physiology, and the effects of disease states on the normal physiology
- Describe the anatomy and physiology of the cardiac valves, left ventricle, right ventricle, atria, major cardiac vessels, and circulatory system in both normal and diseased states
- Describe the normal conduction pathways of the heart and their clinical significance in disease
- Describe embryologic circulation, the development of the heart, and fetal physiology as it applies to adult congenital heart disease
- Understand the effect of thoracotomy and one-lung ventilation on pulmonary physiology, ventilation/perfusion mismatch, and pulmonary airway mechanics
- Describe the altered respiratory physiology of the immediately postoperative ventilated patient with significant surgical incisions and pain (sternotomy, large abdominal incision)
- The metabolic effects and endocrine response to anesthesia and surgery
- Describe common physiological changes occurring in the postoperative period and the impact

these have on end-organ function (neurological, renal, cardiac, hepatic, gastro-intestinal)

Pathophysiology of Adult Cardiovascular Disease and Surgery

By the end of the interactive lecture, the fellow will be able to:

- Describe shock, heart and hemodynamic failure, congenital defects, COPD, cardiopulmonary reserves, and acquired cardiac and pulmonary diseases
- Know the epidemiological, medical, and surgical aspects of vascular disease (pathophysiology of atherosclerosis, natural history of patients with peripheral vascular disease, medical therapy of atherosclerosis)
- Describe the pathophysiology of cardiomyopathy
- Describe the immunological and metabolic response during CPB
- Know the diagnosis and management of altered lung function and infection prevention
- Describe total circulatory arrest

Pharmacological Aspects of Adult Cardiac Patients

By the end of the interactive lecture, the fellow will be able to understand:

- Commonly prescribed medications for cardiac surgical patients, their implications for disease, and their impact on anesthetic management
- Commonly used cardiac anesthetics, titrations, and dosages and their effects on cardiac function
- Antiarrhythmic drugs and nitric oxide
- Heparin, antiplatelet agents, and anesthetic implications
- Protamine for heparin reversal, along with side effects and complications
- The use of antifibrinolytic agents, blood products (PRBC, FFP, platelets, cryoprecipitate) and blood alternatives (albumin, starch), as well as transfusion reactions and complications
- Coagulation drugs (DDAVP, activated factor VIIa), their indications, contraindications, dosages, and complications
- Commonly used vasodilators, vasoconstrictors, inotropic agents, and their indications, dosages, and side effects
- The appropriate use of pain medications, non-steroidal anti-inflammatory drugs, and regional anesthetic techniques in cardiac surgical patients
- Pharmacology of perioperative risk reduction strategies (lipid lowering agents, β-blockers, aspirin)
- Total circulatory arrest, pharmacokinetics and pharmacodynamics of anesthetic and vasoactive drugs
- Antibiotics, prophylactics, and bronchodilators

Monitoring of Cardiovascular Patients During Surgery

By the end of the interactive lecture, the fellow will be able to apply, insert, instruct, and interpret invasive and other monitoring and therapeutic devices, including but not limited to:

- Arterial catheters
- Central venous catheters (subclavian, internal jugular, external jugular, femoral)
- Pulmonary artery catheters
- Lumbar spinal drains (for thoracoabdominal aneurysms)
- TEE probe
- Esophageal pacer
- Lumbar and thoracic epidural catheters
- Expired oxygenation gas monitoring
- Interpret data obtained from these monitoring devices, including:
    - Invasive arterial blood pressure monitoring
    - Pulmonary artery (PA) catheter monitoring
    - PA waveforms and pulmonary capillary wedge (PCW) tracings
    - Cardiac output by thermodilution and waveforms

- Mixed venous oxygen saturation
- Transesophageal echocardiography
- Cerebral oximetry
- Activated clotting time
- Thromboelastograph

Anesthesia for Coronary Artery Bypass Grafting (CABG)

By the end of the interactive lecture, the fellow will be able to understand the perioperative anesthesia management of:

- On-pump coronary artery bypass grafting
- Off-pump coronary artery bypass
- Minimally invasive cardiac surgery: MID-CAB

PBL: Anesthesia for Cardiac Valvular surgery

By the end of the interactive PBL session, the fellow will be able to understand the perioperative anesthesia management of:

- Mitral stenosis, severe or critical
- Aortic stenosis, severe or critical
- Hypertrophic cardiomyopathy
- Mitral regurgitation
- Pulmonary stenosis
- Tricuspid stenosis
- Tricuspid regurgitation
- Mixed valve lesions
- Infective endocarditis

PBL: Anesthesia Management of Vascular Surgery

By the end of the interactive PBL session, the fellow will be able to describe the perioperative anesthetic management of:

- Lower extremity revascularization
- Carotid artery revascularization and proper neurological monitoring
- Ascending aortic reconstruction and Bentall surgery after aortic aneurysm or dissection
- Total circulatory arrest and cerebral protection
- Thoracoabdominal aortic aneurysm (TAAA) and CSF drainage
- Endovascular surgeries

Anesthesia for Cardiac Catheterization: Laboratory Procedures

By the end of the interactive lecture, the fellow will be able to describe the:

- Anesthesia challenges and remote area setup and considerations.
- Radiation protection
- Diagnostic and interventional procedures
- Preoperative evaluation
- Anesthetic implications of pacemakers
- Monitoring
- Specific procedures and effects of pacemakers
- Complications of different procedures

PBL: Anesthesia for Pericardiectomy Surgery

By the end of the interactive PBL session, the fellow will be able to describe the:

- Different types of pericarditis causing tamponading
- Proper preoperative evaluation
- Intraoperative invasive monitoring and anesthesia management
- Postoperative pain management

Anesthesia for Cardiac Patients for Noncardiac Surgery

By the end of the interactive lecture, the fellow will be able to describe the:

- Management of patients with ischemic heart disease for noncardiac surgery
- Preoperative evaluation and identification of risk factors
- Intraoperative management
- Regional anesthesia and IHD
- Monitoring
- Induction and maintenance of anesthesia
- Intraoperative ischemia
- Postoperative management
- Management of severe valvular heart disease for noncardiac surgery

Anesthesia Management for Adult Congenital Heart Disease

By the end of the interactive lecture, the fellow will understand and be able to:

- Evaluate the patient with adult congenital heart disease
- Know the anatomy and physiology of these patients
- Identify the type of cardiac surgery that had been done, corrective or palliative
- Consider the multiple co-morbidities and risk factors of arrhythmias, cyanosis, pulmonary hypertension, and LV dysfunction
- Redo operation considerations, risk of bleeding, and difficult line insertion
- Consider fast-track anesthesia
- Consider challenging post-operative ICU management of patients with cavopulmonary connections

PBL: Management of Medical Bleeding During Cardiovascular Surgery

By the end of the interactive PBL session, the fellow will be able to describe:

- Normal hemostasis and laboratory evaluation
- Congenital and acquired bleeding disorders
- Blood conservation strategies
- Platelet defects
- Hypercoagulable states
- Anticoagulant therapy
- Thrombolytic therapy
- Procoagulant therapy
- Intraoperative blood loss and replacement
- Postoperative bleeding and reoperation

Perfusion and Cardiopulmonary Bypass (CPB) Management

By the end of the interactive lecture, the fellow will be able to understand:

- The basic components of CPB
- Normal CPB run
- Pathophysiology of CPB

- Putting patient on CPB checklist
- Tacking patient off CPB checklist
- CPB emergencies

Anesthesia Management of Heart Transplantation

By the end of the interactive lecture, the fellow will be able to:

- Understand the indications and contraindications of HT
- Describe the pre-HT assessment protocol
- Describe the preoperative evaluation, etiology, redo sternotomy, PAP, ICD deactivation, medical and mechanical support, and other organ impairment
- Describe careful intraoperative anesthesia induction, monitoring, antibiotics, fluids, steroids, blood products, and challenges during weaning off CPB
- Understand postoperative management and complications

PBL: Anesthesia Management of Pregnant Cardiac Patients

By the end of the interactive PBL session, the fellow will be able to describe the:

- General considerations in pregnant patients
- BMV in pregnancy
- Open heart surgery in pregnancy
- Normal findings in pregnant patients
- Timing of cardiac surgery in pregnancy
- Cardiopulmonary bypass and pregnancy
- Fetal heart rate (FHR) monitoring
- Uterine monitoring
- Aesthetic drugs
- Pregnancy and myocardial infarction
- Pregnancy and heart transplant

Cardiovascular Concerns in Neurosurgical Procedures

By the end of the interactive lecture, the fellow will be able to discuss:

- Cardiovascular concerns during management of raised intracranial pressure
- Cardiovascular concerns during prevention of cerebral injury
- Cardiovascular concerns in intracranial pathology
- Cardiac emergencies during neurosurgical procedures
- Neuropharmacological interventions and cardiovascular concerns
- Management of bradycardia and asystole during neurosurgery

Postoperative Analgesia for Cardiac Surgical Patients

By the end of the interactive lecture, the fellow will be able to understand the:

- Pathophysiology of cardiac surgical pain
- Beneficial effects of adequate postoperative analgesia
- Modalities of postoperative analgesia

Basic Topics Covered in Monthly (TEE) Lectures or Conferences

Including but not limited to:

- Basic Principles of 2D Echo
- Basic Principles of Spectral and Color Doppler
- Basic Cardiac Anatomy and TEE

- Global and Regional LV and RV Function
- Basic and Advanced Evaluation of the Aortic Valve
- Basic and Advanced Evaluation of the Mitral Valve
- Basic and Advanced Evaluation of the Tricuspid Valve
- Basic and Advanced Evaluation of the Pulmonic Valve
- Evaluation of Systolic and Diastolic Dysfunction
- Evaluation of the Aorta
- Evaluation of the Hemodynamically Unstable Patient
- Indications, Complications, and Pitfalls of TEE

3. Pediatric Cardiac Anesthesia Topics/Skills Checklist

Anatomy, Physiology, and Physical Development in Children

By the end of the interactive lecture, the fellow will be able to:

- Describe the transection from fetal circulation, development of the heart, and fetal physiology
  - Closure of the ductus arteriosus
  - Closure of the foramen ovale
  - Closure of the ductus venosus
  - Pulmonary vascular changes
  - Myocardial performance in the neonate
- Describe the different congenital cardiac anomalies and their surgical management
- Describe single-ventricle pathophysiology and specific management requirements
- Describe the altered respiratory physiology of immediate postoperative cardiac cases
- Describe common physiological changes occurring in the postoperative period and the impact they have on end-organ function (neurologic, renal, cardiac, hepatic, gastrointestinal)
- Differentiate between normal and abnormal growth and organ development of a child
- Comprehend the physiological properties of pediatric patients that differ from adults
- Discuss both anatomical and physiological anesthetic considerations for pediatric patients

Pediatric Pharmacology

By the end of the interactive lecture, the fellow will be able to:

- Describe the principles of applied pharmacodynamics and pharmacokinetics in pediatrics in relationship to growth and development
- Compare common medications for cardiac surgical patients including anesthetic agents, vasodilators, vasoconstrictors, and inotropic agents
- Explain the use of antifibrinolytic agents
- Justify the use of blood products (packed red blood cells, fresh frozen plasma, platelets, cryoprecipitate), blood alternatives (e.g., albumin) and homeostasis-stabilizing agents (desmopressin, activated factor VIIa)
- Describe the indications, appropriate doses, and monitoring techniques of common anesthetic and non-anesthetic medications used perioperatively for pediatric patients
- Evaluate the current evidence for concern about the effect of anesthetics on the growing brain

Pathophysiology of CHD

By the end of the interactive lecture, the fellow will be able to describe the:

- Concept of shunting
- Classification of anatomic shunts
- Complex shunts
- Single-ventricle physiology
- Intercirculatory mixing
- Pulmonary vascular pathophysiology and control
- Myocardial ischemia

Preoperative Evaluation and Preparation

By the end of the interactive lecture, the fellow will be able to describe:

- Psychological considerations
- History and examination
- Laboratory data interpretation
- Preoperative fluid therapy
- Preoperative medications

Anesthesia for Children with Congenital Heart Diseasel

By the end of the interactive lecture, the fellow will be able to:

- Identify specific perioperative challenges in pediatric cardiac patients
- Comprehend anesthetic management of cardiopulmonary bypass during pediatric cardiac surgery
- Plan anesthetic management for catheterization procedures (diagnostic, interventional, and electrophysiologic)
- Describe anatomical and physiological implications of the following common defects and their surgical corrections:
    - Atrial septal defect
    - Ventricular septal defect
    - Patent ductus arteriosus
    - Pulmonary valve implantation

Anesthesia for Children with Congenital Heart Disease II

By the end of the interactive lecture, the fellow will be able to describe the anatomical and physiological implications of the following defects and their surgical corrections:

- Aortic arch abnormalities
- Tetralogy of Fallot
- Transposition of the great arteries
- Single-ventricle (Norwood, Glenn, and Fontan) procedures
- Right ventricular outflow tract obstruction
- Left ventricular outflow tract obstruction

Anesthesia Management of ASD, VSD, and AV Canal Closure

By the end of the interactive lecture, the fellow will be able to describe the:

- Restricted or non-restricted shunt
- Direction of the shunt
- Balanced anesthesia
- Balanced pulmonary to systemic circulation
- Pulmonary hypertension crises
- Direct monitoring of the PAP
- Post-operative heart block

Anesthesia Management of PDA Closure

By the end of the interactive lecture, the fellow will be able to describe the:

- Thoracotomy approach
- Fast track anesthesia
- Post-operative pain management

Anesthesia Management of Coarctation of Aorta

By the end of the interactive lecture, the fellow will be able to describe the:

- Severity of coarctation
- The type and severity of associated heart lesions
- Arterial line insertion challenges

Anesthesia Management of TOF

By the end of the interactive lecture, the fellow will be able to describe:

- Anatomical defects
- Shunt direction
- Hypoxic and hyper-cyanotic episodes
- Preoperative optimization

Anesthesia Management of TGA

By the end of the interactive PBL session, the fellow will be able to describe the:

- Embryology
- Type of concordance
- Anatomy of the coronaries
- Emergency septostomy
- Prostin infusion
- Type of surgical intervention
- Palliative or therapeutic repair
- Post-CPB management
- Open or closed sternum

Anesthesia Management of Anomalous Pulmonary Venous Return

By the end of the interactive lecture, the fellow will be able to describe:

- The type and severity of shunt
- Total or partial
- Intra-cardiac or extra-cardiac
- Pulmonary edema

Anesthesia Management of Single-Ventricle Infants

By the end of the interactive lecture, the fellow will be able to describe:

- Left or right outflow obstructions
- PDA stenting vs ligation
- BT shunts
- Initial procedure to improve pulmonary blood flow
- Initial procedure to improve systemic blood flow
- Post-operative ventricular dysfunction
- Glenn or Fontan operation
- Fontan and Glenn complications

PBL: Deep Hypothermia Circulatory Arrest

By the end of the interactive PBL session, the fellow will be able to describe the:

- Indications
- Preparations

- Technique
- Complications

Anesthesia Management of Truncus Arteriosus

By the end of the interactive lecture, the fellow will be able to describe:

- Single-ventricular physiology
- Bidirectional shunt
- Congestive heart failure

Anesthesia Management of Heart and Lung Transplantations

By the end of the interactive lecture, the fellow will be able to:

- Describe the common surgical techniques and their considerations in major organ transplant surgeries
- Assess transplant recipients with end-organ failure for possible optimization of their condition for surgery
- Create an anesthetic plan for transplant surgeries based on best-practice evidence

Monitoring During Pediatric Cardiac Anesthesia:

By the end of the interactive lecture, the fellow will be able to:

- Interpret the electrocardiogram (ECG) for ischemia, infarction, arrhythmias, and paced rhythms
- Acquire skills of arterial and central venous cannulation (with ultrasound)
- Interpret central venous pressure and know the indications, complications, and management
- Know the basics of introductory transesophageal echocardiography (TEE), including techniques of probe insertion and several basic views, and implications and application in the critical-care patient
- Know the significance of temperature management in the intraoperative period, including hypothermic techniques
- Understand the indicators of volume status, especially when weaning from bypass, including the findings from invasive monitors, TEE, and clinical indicators

PBL: Anesthesia for Pediatric Cardiac Patients Scheduled for Noncardiac Surgery

By the end of the interactive PBL session, the fellow will be able to:

- List the anesthetic considerations for pediatric cardiac patients scheduled for noncardiac surgery
- Interpret cardiac imaging studies, ECG, and diagnostic catheterization results
- Solve perioperative challenges in pediatric patients with corrected cardiac defects
- Solve perioperative challenges in pediatric patients with uncorrected cardiac defects
- Formulate a plan for postoperative transfer and disposition

PBL: Thoracic Surgery Anesthesia for Pediatric Patients

By the end of the interactive PBL session, the fellow will be able to:

- Describe the changes in ventilation/perfusion during thoracic surgery
- Choose age-appropriate available methods for lung isolation
- Explore different anesthetic plans for intrathoracic lesions (e.g., tracheoesophageal fistula, congenital cystic adenomatoid malformation, lobar emphysema)
- Create an organized approach to intraoperative adverse events during common pediatric thoracic cases

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