curriculum





MD Cardiology

RAWALPINDI MEDICAL UNIVERSITY

RAWALPINDI

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**CURRICULUM/STATUTES & REGULATIONS FOR 5 YEARS DEGREE PROGRAM IN CARDIOLOGY**

**(MD CARDIOLOGY)**

**RAWALPINDI MEDICAL UNIVERSITY (RMU)**

**RAWALPINDI**

**STATUTES**

**Nomenclature Of Proposed Course**

The name of degree program shall be MD Cardiology. This name is well recognized and established for the last many decades worldwide.

**Course Title:**

MD Cardiology

**Training Centers**

Departments of Cardiology (accredited by RMU) in affiliated institutes of Rawalpindi Medical University.

**Objectives:**

1. To train in chosen clinical field through a competency-based training system.

2. To develop skills in conducting research and its application to clinical environment.

3. To enable trainees to use modern techniques and technologies effectively.

4. To provide training in cognitive, psychomotor and affective domains.

**Admission criteria:**

Application for admission in MD Cardiology will require:

1. MBBS Degree

2. One Year of House Job

**Duration of Course**

The duration of MD Cardiology course shall be five (5) years with structured training in a recognized department under the guidance of an approved supervisor. The course is structured as follows:

The trainee will spend the initial six months of the induction period in the parent cardiology department for initial orientation, preparation of the synopsis and the research project and will undertake the mandatory workshops during this period. After initial six months, formal training and rotation in the field of general medicine for eighteen months will start in a recognized department with the approval of the supervisor in cardiology. During this period the resident must get the research synopsis approved by the concerned department of the university. During the period of rotation, the trainee will maintain a constant liaison with the supervisor in cardiology to keep him updated about his progress in training. At the end of 2nd year, the candidate will take up Mid Term EXAM. During the 3rd, 4th, & 5th years, of the program, there will be training rotations in clinical and interventional cardiology, both in diagnostic as well as therapeutic sections.

The candidate shall undergo clinical training to achieve educational objectives of MD Cardiology (knowledge & Skills) along with rotation in the relevant fields, which will be carried out during the last 3 years of the program. The clinical training shall be competency based. There shall be generic and specialty specific competencies and shall be assessed by continuous Internal Assessment.

The Research Component and thesis writing shall be completed over the five years duration of the course.

**AIMS AND OBJECTIVES OF THE COURSE**

**AIM**

The aim of five years MD program in Cardiology is to train residents to acquire the competency of a specialist in the field of Cardiology so that they can become good teachers, researchers and clinicians in their specialty after completion of their training.

**GENERAL OBJECTIVES**

MD Cardiology training should enable a resident to acquire:

1. Overall assessment of patient care that is effective, safe, timely, efficient, equitable and patient-centered.

2. Medical knowledge about established and evolving biomedical, clinical and cognate sciences (e.g., epidemiological and social-behavioral) and the application of this knowledge to patient care.

3. Interpersonal and communication skills that result in effective information exchange and teaming with patient, their families and other health professionals.

4. Professionalism, as manifested through a commitment to carrying out professional responsibilities, adherence to ethical principles and sensitivity to a diverse patient population, providing cost-effective, ethical and humanistic care.

5. System-based practice, as manifested by actions that demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value.

6. Practice-based learning and improvement that involves investigation and evaluation of their own patient care, appraisal and assimilation of scientific evidence and improvement in patient care.

**Basic Sciences & Therapeutics**

* A trainee must have adequate knowledge about Medical ethics & Professional values and human basic sciences including anatomy, physiology, biochemistry, pathology, pharmacology and behavioral sciences.
* A trainee must have a detailed knowledge of cardiovascular anatomy, physiology, biochemistry, pathology, pharmacology & therapeutics.

**Curriculum outline:**

It is a five-year program in which initial two years will focus on Medicine and allied specialties and remaining three years on Cardiology.

First 6 months will be inpatient and outpatient orientation and care in which main goal of fellow is to get acclimatize to hospital inpatient and outpatient departments’ working. Then the fellow will rotate for the next 18 months in medicine and allied specialties to increase his competencies in overall care of patients who have other comorbidities along with cardiac ailments.

During the third, fourth and final year, the cardiology residents shall rotate in the following clinical services. This is accomplished through the supervised performance of consultations, daily hospital rounds and active participation in procedures under the supervision of attending faculty. Clinical decision-making and a cost-effective scholarly approach to cardiology problems are emphasized through teaching rounds, clinical rounds and clinical conferences. The 3rd year cardiology resident is expected to present cases at the clinical conferences.

**Third Year MD Cardiology**

* Four months (4) Coronary care unit (CCU)
* Six (6) months Echocardiography
* Two months (2) Preventive Cardiology

**Fourth Year MD Cardiology**

The resident will complete the required time for the year, which include:

* Two months (2) Noninvasive cardiac testing including exercise stress testing.
* Two months (2) in Heart Failure
* Two months (2) in Cardiac consultation
* Six months (6) in cardiac catheterization lab:

 During this time, the resident is expected to develop basic cognitive and

 procedural skills including:

1. Left and right heart catheterization
2. Temporary transvenous pacemaker insertion
3. Intra-aortic balloon pump placement

**Final Year MD Cardiology**

* Two months (2) CV imaging / CT angiography
* Two months (2) Nuclear cardiology
* Two months (2) Electrophysiology
* Two months (2) Cardiac surgery
* Four months (4) Paediatric Cardiology

The inpatient experience during these years will comprise of non-laboratory clinical practice activities i.e. consultations, cardiac care unit and post-operative care of cardiac surgery patients. In addition to further developing clinical and echocardiographic skills, the resident will develop more complex procedural skills as outlined below (cardiac catheterization, interventional procedures, transesophageal echocardiograms and electrophysiology studies) and will develop an appreciation for the indications, contraindications and technical limitations of these procedures. He/she will serve as a primary teaching resource for medical students, residents and first year cardiology residents.

The resident will participate actively in the performance of diagnostic cardiac catheterization as well as interventional procedures and will be involved in the training of junior residents assigned to the catheterization laboratory. All of this will be under the close supervision of the attending faculty.

In the intensive care and cardiac care setting, the senior cardiology resident will supervise and assist in the performance of emergency procedures such as right heart catheterization, temporary pacemaker insertion, pericardiocentesis, and elective and emergency cardioversions.

The senior cardiovascular resident will spend more time in the echocardiography laboratory where he will be responsible for supervising exercise and chemical stress tests as well as improving his skills in echocardiography with particular emphasis on transesophageal echocardiography and intravascular ultrasound.

In the electrophysiology laboratory, the senior resident will be participating in diagnostic electrophysiology procedures, ablation procedures, insertion of permanent pacemakers and insertion of implantable cardioverter defibrillators.

The trainees will maintain records of participation in the form of a logbook documenting their participation in procedures such as cardiac catheterization, interventional procedures, echocardiograms, transesophageal echocardiograms, cardioversions, pacemaker implantations, and electrophysiologic procedures such as ablations.

**SPECIFIC LEARNING OUTCOMES**

Following competencies are expected from a resident completing MD Cardiology training;

1. Adult/ Clinical Cardiology
2. Paediatric Cardiology
3. Cardiovascular Surgery
4. **Adult/ Clinical Cardiology**

**Clinical Cardiology**

Includes training to acquire a comprehensive knowledge and skill in the anatomy, patho-physiology, diagnosis and management of cardiovascular diseases.

**Procedural Competencies**

The trainee is expected to be competent in performing the following procedures by the end of core training. The trainee must be able to outline the indications for these interventions. For invasive procedures, the trainee must recognize the indications for the procedure, the importance of valid consent, aseptic technique, safe use of local anesthetics and minimization of patient discomfort.

* Venepuncture
* Cannula insertion, including large bore
* Arterial blood gas sampling
* Pleural tap and aspiration
* Intercostal drain insertion: Seldinger technique
* Central venous cannulation
* Initial airway protection: chin lift, Guedel airway, nasal airway, laryngeal mask
* Basic and, subsequently, advanced cardio-respiratory resuscitation
* DC cardioversion
* Urethral catheterization
* Nasogastric tube placement and checking
* Electrocardiogram
* Temporary cardiac pacing by internal wire or external pacemaker

**ECG and Holter Monitoring**

The goal of training in ECG and Holter monitoring is to become familiar with most clinically encountered arrhythmias, understand the clinical importance of these findings, and have a basic understanding of the physiologic mechanisms involved in ECG waveforms. For Holter monitoring, the resident should understand the differences in record.

**ECG And Ambulatory Electrocardiography**

* Patterns of electrocardiography
* Clinical implications, sensitivity, specificity and normal versus abnormal variants
* Electrocardiographic interpretation of Normal ECG
* General concepts of arrhythmia recognition in:
	+ - Sino atria
		- Atria
		- AV node
		- Ventricles
		- AV block
		- Abnormalities of ST and T segments
		- Chamber abnormalities
		- IVCD's
		- MI's
		- Pacemaker rhythms

**Emergency Cardiology/ Cardiac Care Unit**

A trainee in cardiology must acquire the knowledge and skills to recognize, evaluate and manage all manifestations of cardiovascular disease including:

* Acute coronary syndromes
* Hypertensive heart disease
* Cardiac arrhythmias
* Valvular heart disease
* Cardiomyopathy
* Pulmonary heart disease
* Peripheral vascular disease and Pulmonary Embolism
* Cerebral vascular disease
* Heart disease in pregnancy
* Adult congenital heart disease
* Coronary artery disease and its manifestations and complications
* Non-cardiac chest pain
* Acute and chronic congestive heart failure
* Cardio-Pulmonary Resuscitation
* Implantation of temporary pacemaker
* Minor surgical procedures like CVP, Arterial line, swan Ganz monitoring**.**
* Complications of therapy
* Aortic dissection and other vascular emergencies
* Hypotension, syncope and shock
* Pericardial diseases and cardiac tamponade

### CARDIAC CARE UNIT CURRICULUM

**Goals**

* Become competent in the initial evaluation and comprehensive care of critically ill patients.
* Understand indications for admission to the ICU.
* Formulate and understand the differential diagnosis, diagnostic approach and treatment plan of specific conditions pertaining to critically ill patients.
* Set initial ventilator settings for patients with acute respiratory failure, indications for tracheal intubation and non-invasive ventilation.
* Understand and apply principles of resuscitation and stabilization of critically ill patients.
* Function as a member of a multidisciplinary team caring for critically ill patients. Become an effective communicator with family members and to learn how to address end of life issues with patients and family.

### Specific Learning Objectives Patient care:

* Demonstrate competency in medical interviewing, physical diagnosis and data collection of critically ill patients.
* Formulate a differential diagnosis and outline a thorough, comprehensive and organized plan.
* Demonstrate organizational skills necessary for the care of critically ill patients, including prioritization of patient problems and the use of information technology.

### Medical knowledge:

* Efficiently and effectively record daily progress and events in the medical record. Know the indications for invasive and non- invasive forms of ventilation. Understand the basic principles of mechanical ventilation, modes of ventilation, ventilatory parameters; approach to reducing ventilatory support; complications of mechanical ventilation; approach to patient dysynchrony, distress or alarms; and indications for tracheostomy.
* Understand the principles and methods of fluid resuscitation for various shock states, the use of crystalloids or colloids, assessing perfusion at the bedside and the endpoints of resuscitation.
* Understand the approach to a patient with fever in the ICU/CCU, including diagnosis and treatment of hospital acquired infections as well as noninfectious causes of fever.
* Interpret simple and mixed acid-base disorders. Understand the clinical manifestations, pathophysiology and treatment of common electrolyte disturbances.
* Understand and address the basic nutritional requirements of critically ill patients.
* Understand the diagnosis and treatment of anxiety, agitation, pain and delirium in the ICU, including the appropriate use of sedatives with paralytics and identification of drug/alcohol withdrawal syndromes.
* Understand the evaluation, approach and treatment of seizures (status epilepticus), CVA, coma and the basic approach to diagnosis of brain death.
* Understand the indications/contraindications for DVT and stress ulcer prophylaxis.
* Understand the indications/contraindications for, risks of, and be able to perform: venipuncture, arterial puncture, arterial catheterization, central venous access, lumbar puncture & nasogastric tube placement.
* Participate in family meetings and be able to discuss general condition of a patient with immediate family members.

### Communication skills

* Participate in family meetings and be able to discuss general condition of a patient with immediate family members.
* Demonstrate an ability to obtain informed consent for procedures and imaging studies
* Learn the process of death notification

### Professionalism

* Consistently demonstrate respect for patients and staff and place patients’ interests above all other considerations

### Daily Schedules & Rounds

The team will be responsible for the provision of care to all patients in the CCU. The day interns are responsible for the care of their assigned patients, although they, as well as senior residents, should be familiar with all of the patients in the CCU . Before morning rounds begin the day interns should have examined each of their patients, reviewed the current data (laboratory studies and cultures) & formulated an organized, systematic plan for each component of the patient's problem list. In general presentations of existing patients on rounds should consist of:

1. Overnight events.
2. Vital data – Temp max, pulse range, BP range respiratory rate, ventilator settings (if applicable), oxygen saturation and input/output (including overall fluid balance and average hourly urine output).
3. Directed physical examination that is specific to that particular patient.
4. Review of laboratory results, including cultures (these must be reviewed daily!)
5. Review of the medication list, including dosages and intervals (many of our patients have fluctuating renal and hepatic function, therefore it is of paramount importance to review this information in order to identify and prevent toxicity).
6. Assessment – this must be brief and concise.

##### Plan – this must be organized and systems oriented! For example:

* + **Respiratory** – continue or change aspects of ventilation, etc.
	+ **Infectious** – what antibiotics the patient is on and what are we trying cover, culture results, etc.
	+ **Cardiovascular/Hemodynamic** – vasopressors in use, therapies being employed based on invasive monitoring, etc.
	+ **Hematologic** – bleeding problems, anticoagulation, etc.
	+ **Metabolic** - fingerstick monitoring, insulin requirements, electrolyte replacements, changes in renal function, etc.
	+ **Alimentary/Nutrition –** assessment of patient’s nutritional status, hepatic dysfunction, type of NGT feeds, rate of infusion, TPN/PPN, etc.
	+ **Neurologic** – sedatives or paralytic drugs, etc.
	+ **DVT Prophylaxis** – pneumatic compression devices (at the bare minimum) and LMWH if there are no bleeding issues or contraindications.
	+ **Stress Ulcer Prophylaxis** – either an H2 blocker or a PPI. (This applies to all patients who are mechanically ventilated or NPO.)

It is important to maintain a systematic approach even if there is no problem in a particular system. This ensures that all aspects of ICU care are being addressed. Afternoon rounds will begin at 5PM to provide follow-up of the day’s events, new admissions and plans for the on-call residents and fellow.

### Notes & Documentation

* A progress note from resident is required for each patient, every day!
* Please make sure to fill out consultation requests completely, including date and time called, reason for consultation; print and sign your name.
* Whenever a patient is being transferred to the general ward or to another service a detailed summary note, including presenting complaint and hospital course is required, in addition to the daily note.

### Patients who die in the CCU require the following:

1. **Death Note** – a note documenting that there are no signs of life on physical examination.
2. **Death Summary** – a note that details why the patient was admitted and brief hospital course.
3. **Code Note (if applicable)** – a note documenting when a code was called, status of the patient on your arrival, ACLS protocol employed, duration of the code and outcome.

### Death Certificate.

If a patient is discharged home from the ICU then a standard discharge note is required. Charts that are lacking these components are deemed incomplete and will require that the resident or intern go to Medical Records to complete deficient charts. Failure to comply with this policy will be noted by the Department of Medicine.

### Standard Precautions

* Hand washing or use of an alcohol-based gel is mandatory before and after each patient interaction. This is the best way to reduce the spread of bacteria from patient to patient**.**
* Stethoscopes should be cleaned between each patient contact with an alcohol pad. Resistant bacteria require masks, gowns, and gloves for ANY contact in the room. When used, dispose in proper receptacle IN the patient's room. Do not bring flow sheets or charts into isolation rooms.
* Respiratory masks are required for all patients on respiratory isolation.

### Invasive Procedures

The Cardiology fellow is responsible for supervising or performing all relevant invasive procedures. Appropriate informed consent must be obtained from the patient prior to the procedure. Residents must be supervised for procedures they are not certified in, by a certified fellow. **Do not attempt to perform a procedure if you are not confident in your ability to do so.**

### Central venous access site preference: jugular vs. subclavian vs. femoral. Femoral access should be obtained only for emergent access, since there is a higher risk for infection and DVT.

* Sterile technique – cap, sterile gown & gloves, drapes, supervision. Please be very attentive to your field and maintenance of sterility. Remember, the technique you employ during the procedure will determine the likelihood of developing an infectious complication!
* Povidone iodine solution is used for sterilization in standard way.
* Antibiotic-coated central lines (blue catheters) should be changed every 10 days & arterial lines every 7 days. In addition all catheter sites should be evaluated each day for signs of infection.
* Guidewire line changes for central venous lines ONLY when a new stick cannot be done or when changing a PA catheter to TLC (See Protocol) – all venous catheter tips must be cut into a sterile container and sent for semi-quantitative culture.
* Procedure forms should be filled out for ALL invasive procedures done in the CCU.
* Do not draw blood from central lines because it breaks sterility.
* The nurses will do central line and arterial line dressings.

### Orders

**Verbal orders do not exist in the CCU.**

* Admission orders on order sheets, including admission, attending of record, patient’s condition, daily labs, etc.
* All orders must be communicated verbally to the nurse in addition to computer entry. This will ensure that all members of the team know what changes are occurring for a particular patient’s care and that those changes will be implemented in a timely fashion.
* Ventilator changes must be ordered in the computer and communicated directly to the respiratory therapist.
* Review medication sheets daily from the nurses' medication list.
* TPN & PPN order must be in by 12 noon.

### Labs

* Review need for daily labs, EKG’s and CXR’s.
* Respiratory therapists are certified to do radial ABGs only (and not other labs)

### Clinical Protocols

* Sedation is titrated to the Ramsey scale. Use midazolam infusion if first choice is anxiolysis/sedation. For anticipated short term intubations, use propofol. For agitated delirium, use haloperidol by intermittent dosing, rarely by infusion.
* Neuromuscular blockade - preferred agent is cis-atracurium which is mostly metabolized in the blood and tissues, so it can be given in liver or renal failure. Dose is titrated to ventilator synchrony, and is monitored by the "train of four." A drug holiday should ideally be given once a day to permit a neurological exam, to see if the patient still needs to be paralyzed and if the level of sedation is adequate. Daily CK levels must be sent while the patient is on continuous neuromuscular blockade.
* DVT prophylaxis - pneumatic compression boots, low dose warfarin .Double prophylaxis (compression boots and something else) should be given to high risk patients (sedated paralysis, hemiplegia, and femoral lines - virtually all of our patients).
* GI prophylaxis - all mechanically ventilated or NPO patients must receive prophylaxis with an H2 blocker or PPI. If there is no clinical preference H2 blocker should be the default choice and whenever possible enterally.

### Nutrition

Although the clinical nutritionist often assesses each patient and recommends nutritional orders, house staff is expected to understand and know the patient's nutritional regimen and requirements.

### Bedside & Transport Equipment

You should be familiar with how to use the standard equipment, including bed controls, Ambu-bags, IV pumps, monitoring equipment and inline suction catheters. For transporting patients, you should be familiar with the Ambu-bag/oxygen mask and emergency medications, as well as what medications the patient are being transported with and which IV site can be used to administer medications in an emergency. **IF YOU DON'T KNOW HOW TO USE SOMETHING, SAY SO!!**

###### Privacy

Privacy should be maintained while examining a patient or doing a procedure remember to pull curtains appropriately. Also don't forget that though the patients may be sedated, they may still hear you talking about them, so use judgment when talking about prognosis, etc. If you remove restraints on a patient or put the side rails down to do a procedure, **PLEASE REMEMBER TO REPLACE THE RESTRAINTS AND PUT THE RAILS BACK UP.**

In order for the CCU experience to be valuable and rewarding it is important to spend as much time as possible at the patient’s bedside in order to appreciate the clinical relevance of principles that are discussed on rounds, such as fluid resuscitation. Also by working with other members of the team (nurses, nutritionists, pharmacists, physician assistants and respiratory therapists) you will maximize your knowledge base by understanding the different perspectives of caring for the critically ill. By making a therapeutic decision and following up on its effect you will better understand the practice of Critical Care Medicine.

**PALLIATIVE CARE CURRICULUM:** One of our departmental performance improvement projects is to improve the teaching of palliative care. Our goals for you are straightforward.

### Goals

By the end of the training, we want you to achieve the following:

* Understand how to provide optimal care for patients whose conditions cannot be cured and those at the end of life
* Demonstrate proficiency in the use of analgesics, particularly narcotic analgesics, in the setting of chronic pain
* Know how to manage the common non-pain symptoms that arise in end of life care
* Be able to communicate effectively and empathically with patients and families in delivering bad news, and in discussing prognosis of common cancers, advance directives, DNR orders, switching from aggressive care to palliative or hospice care, and other issues in end of life care
* Understand the ethical issues involved in palliative care
* Utilize all available resources, including hospice care, to provide for patients’ needs and ensure a smooth transition to outpatient care

**Noninvasive Diagnostic Cardiology**

Includes training in ECG and Holter monitoring, echocardiography, ETT, radionuclear cardiac diagnostic procedures including cardiac perfusion imaging procedure, cardiac CT scan and cardiac MRI. Training is comprised of the following rotations

**Echocardiography**

Trainee in cardiology must acquire a comprehensive knowledge and skills about the use of echocardiography. Training will include knowledge in the basic aspects of ultrasound, instrumentation, the ability to perform routine transthoracic and transesophageal studies. A trainee must acquire the knowledge and skill to use Doppler examination in clinical practice including Tissue Doppler imaging and strain/speckle tracking echocardiographic imaging. Salient features of training in echocardiography department include:

**Echocardiography Procedures**:

* Ultrasound transducer and the Doppler flow signals.
* Transesophageal echocardiography
* Intraoperative transesophageal echocardiography
* Stress echocardiography
* Dobutamine stress echocardiography
* Contrast echocardiography
* Tissue Doppler imaging
* Strain/speckle tracking echocardiographic imaging

**Cognitive Skills:**

* Indications for echocardiography.
* Case specific knowledge of differential diagnostic problems and specific echocardiography techniques required conducting a thorough investigation.
* Alternatives to echocardiography.
* Physical principles of echocardiography image formation
* Doppler evaluation of blood flow velocity measurement.
* Diagnosis and evaluation of cardiac abnormalities due to acquired and congenital heart disease.
* Fluid dynamics of normal and abnormal blood flow patterns due to acquired and congenital heart disease.
* The resident must show the ability to correlate the findings by cardiac auscultation and electrocardiography with echocardiography-Doppler results.
* The ability to communicate the results of the echocardiography examination to the patient, physician, and the medical record.
* Operation of the echocardiography equipment and all the controls affecting the quality of image acquisition.
* Quantitative analysis of the echocardiography examination and generation of an understandable report.
* All cardiology residents must acquire the knowledge and experience necessary to be fully capable of performing and interpreting M-Mode, 2-Dimensional and Doppler examination independently, under the supervision of the laboratory director and should be competent to perform and interpret various special echocardiographic procedures.
* For exercise and pharmacologic stress echocardiography, the trainee must have participated in at least 100 supervised studies beyond level 2 training; this represents a minimal amount of specialized training.

**Exercise Tolerance Test (ETT)**

During rotation in ETT lab, the trainee should be acquainted with the software and hardware used for the test. The trainee must develop a comprehensive knowledge about its different clinical utilities, pathophysiology, indications, contraindications, limitations, complications and interpretation of the test.

**Heart Failure:**

The aim of this rotation is to train fellows in the care of patients with heart failure with both reduced and preserved ejection fraction due to multiple etiologies. Fellows should learn the interpretation and application of invasive hemodynamics and pharmacologic therapy for heart failure. Furthermore, fellows should be introduced to the management of patients with mechanical circulatory support and cardiac transplantation. The following is expected from the trainees:

* Effectively complete history and physical exam, understanding relevance as well as limitations of findings in patients with heart failure.
* Identify signs of volume overload and hypoperfusion on physical exam.
* Execute diagnostic work up to identify etiology of new onset heart failure.
* Know and effectively utilize pharmacologic therapy for heart failure including indications, contraindications and mechanism of action.
* Integrate information from multiple diagnostic procedures in the diagnosis and management of patients with heart failure.
* Know indications and contraindications for vasoactive and inotropic medications and use effectively in advanced heart failure.
* Accurately interpret invasive hemodynamic measurements and understand implications for management, initially with supervision.
* Understand staging of heart failure and natural history of the condition.
* Review the pathophysiology of heart failure in detail and recognize the roles of neurohormonal activation and left ventricular remodeling.
* Integrate pathophysiology and management of heart failure with other systemic diseases, including renal failure.
* Discuss indications and contraindications for cardiac transplantation and mechanical circulatory support.
* Perform, interpret, and apply clinical reasoning to invasive hemodynamic monitoring, initially with supervision.
* Manage cardiac arrhythmias in patients with heart failure.
* Know indications and contraindications for implantable cardioverter-defibrillators and cardiac resynchronization therapy and effectively refer for device therapy as indicated.
* Understand fundamentals of left ventricular assist device management, initially with supervision.
* Understand the role of palliative care and hospice in heart failure and refer patients as indicated.
* Effectively identify appropriate candidates for mechanical circulatory support (both as a bridge to transplant as well as destination therapy) and cardiac transplant.
* Be able to provide effective management of patients with advanced heart failure in both the inpatient and ambulatory settings.

**Nuclear Cardiology, Cardiovascular Imaging and Stress Testing**

During rotation in Nuclear Cardiology department the trainee will get acquainted with performance of different diagnostic tests and their application in clinical cardiology.

* Basic physics and instrumentation in Nuclear Cardiology
* Standard treadmill stress tests.
* The mechanism of action, efficacy, indications, and contraindications of pharmacological stress testing.
* The clinical outcome assessment.
* Indications for specific Nuclear Cardiology tests, the safe use of radionuclides, basic instrumentation, and image processing.
* Most commonly used radionuclides, including their physical properties and bio-availability
* Imaging studies with regards to coronary anatomy and various potential acquisition abnormalities
* Radiopharmaceutical agents in Nuclear Cardiology: properties and kinetics.
* Myocardial perfusion imaging: Planar and SPECT
* Protocol and techniques, acquisition, processing, and quantification of cardiac images.
* Artifacts: Types of artifacts, detection, and attenuation correction.
* Exercise treadmill and pharmacological stress testing (with myocardial perfusion imaging).
* Radionuclide imaging in risk assessment of CAD.
* Suspected of known CAD*.*
* Risk assessment in acute coronary syndromes.
* Risk assessment before non-cardiac surgery
* Radionuclide evaluation post CABG and PCI
* Radionuclide imaging in the emergency department and chest pain unit
* Assessment of myocardial viability by radionuclide imaging
* Magnetic resonance imaging
* Multi-detector and electron-beam computed tomography
* Positron emission tomography other applications of radionuclide imaging

**Cardiac Catheterization**

The resident will acquire the cognitive and motor skills to safely perform cardiovascular diagnostic and therapeutic interventional catheterization procedure under the supervision of an attending cardiologist. The resident is also expected to learn about the indications, contraindications, post-procedural management as well as the knowledge and ability to handle the associated complications.

* Right heart catheterizations and pulmonary artery catheterizations with balloon-tipped, flow-guided catheters and will be trained to interpret the acquired hemodynamic data.
* Insertion of temporary right ventricular pacemakers as well as atrial pacemakers.
* Pulmonary angiography and left heart catheterization including ventriculography and coronary and graft angiography.
* Pericardiocentesis for diagnostic or therapeutic purposes.
* Active participation in the performance of all PCI’s and peri-procedural management.
* Active participation in peripheral diagnostic and interventional procedures including assessment of renovascular hypertension and PVOD.
* Learn the indications and safe performance of femoral closure devices and recognize and manage their potential complications.

**The trainees will become familiar with catheterization laboratory equipment including:**

* Physiologic recorders
* Transducers
* Blood gas and activated clotting time (ACT) analyzers
* Image intensifiers and other x-ray equipment
* Digital imaging
* Report generation

**The trainees shall be instructed in the principles and management thereof:**

* Shunt detection
* Cardiac output determination
* Wave-form pressure recording and analysis.
* Endomyocardial biopsy
* Insertion of intra-aortic balloon counterpulsation equipment

**During the rotation in the catheterization laboratory the trainee gains experience in;**

* The hemodynamics and anatomy of coronary artery disease
* Valvular Heart Disease
* Congenital Heart disease
* Cardiomyopathies
* Diseases of the aorta
* Pulmonary embolism and pulmonary hypertension
* Renovascular hypertension and peripheral vascular occlusive disease.

**Pre-cath work-up of the patients prior to catheterization. This includes;**

* Documentation in the chart of non-invasive tests that have been performed
* Obtaining reports of previous cardiac catheterizations, cardiac surgery and other pertinent angiograms.
* After the pre-cath work-up is completed the trainee discusses the case with the attending cardiologist who will be supervising the procedure.
* The trainees ensure that the appropriate pre-cath blood work-up has been obtained and is normal. Usual blood work includes CBC, platelet count, PT, PTT, electrolytes, BUN and creatinine and glucose. Clotting studies are particularly important in patients on oral anticoagulants.
* The trainees review the patient’s medications and history of allergies. Patients with a history of iodine dye allergy, even an equivocal history, should receive dye allergy prophylaxis prior to catheterization.
* Patients undergoing a PTCA must get antiplatelet medication prior to the procedure unless clear-cut allergies are documented.
* Patients on long-action Insulin should have a reduction in their dose the morning of catheterization.
* Potassium should be in the normal range.
* Patients on Glucophage will have their drug held for 48-72 hours post procedure.
* The cardiovascular resident helps explain the indications and risks for the catheterization and the procedure to the patient and their family, and obtain an informed consent.
* The trainees are expected to participate in the follow-up of the patient after the procedure. This may include performance of closure devices and removal of any sheaths after the procedure, often with continuation of GP IIB/IIIA inhibitor infusion.
* Laboratory, nursing and technical staff may assist in sheath removal.
* Catheterization reports will be completed on the day of the procedure.

 **Cardiac CT:**

 The following is expected from the cardiology resident in this rotation:

* Identify how to appropriately refer and prepare patients with known or suspected cardiovascular disease for cardiovascular computed tomographic imaging and apply the findings in clinical evaluation and management.
* Skill to diagnose and manage adverse reactions to radiographic contrast and beta blockers that may arise during cardiovascular computed tomographic imaging.
* Know the appropriate indications for and radiation-associated risks of cardiovascular computed tomography for screening or evaluating symptoms in patients with known or suspected cardiac diseases and the strategies to minimize exposure of patients, operators, and staff.
* Know the safety measures applicable to cardiovascular computed tomography, including strategies to minimize exposure of patients, operators, and staff to radiation.
* Know the potential adverse effects of iodinated contrast agents used in cardiovascular computed tomography and approaches to preventing and treating complications.
* Know the indications and protocols for and contraindications to administration of beta-adrenergic blocking drugs and nitroglycerin in conjunction with cardiovascular computed tomography.
* Know the principles of acquisition, processing, and reconstruction of cardiovascular computed tomographic images.
* Know the principles of quantitative coronary artery calcium scoring.
* Know the cardiovascular computed tomographic imaging findings in patients with normal chest anatomy, cardiac chambers, great vessels, coronary arteries and veins, and common variants.
* Know the basic characteristic cardiovascular computed tomographic imaging findings associated with coronary atherosclerosis, including plaque morphology and assessment of stenosis severity.
* Know the basic characteristic cardiovascular computed tomographic imaging findings in patients with anomalous coronary arteries and other common congenital anomalies.
* Know the basic characteristic cardiovascular computed tomographic imaging findings in postoperative cardiac surgical patients, including internal mammary artery and saphenous vein bypass grafts.
* Know the basic characteristic cardiovascular computed tomographic imaging findings in patients with valvular heart disease.
* Know the basic characteristic cardiovascular computed tomographic imaging findings in patients with left atrial, pulmonary, and coronary venous abnormalities.
* Know the basic characteristic cardiovascular computed tomographic imaging findings in patients with pericardial diseases.
* Know the basic characteristic cardiovascular computed tomographic imaging findings in patients with cardiomyopathies, infiltrative myocardial diseases, and cardiac masses.
* Know the basic characteristic cardiovascular computed tomographic imaging findings in patients with common diseases of the aorta and great vessels.
* Know the basic characteristic cardiovascular computed tomographic imaging findings in patients with pulmonary embolism and primary and acquired pulmonary vascular diseases.

**Electrophysiology Laboratory**

A cardiology trainee must have a sound knowledge of electrocardiograpy (ECG) and different invasive and noninvasive electrophysiological techniques used to assess patients with arrhythmias in Electrophysiology laboratory including Signal average ECG, Head-up Tilt test, cardiac pacemakers and other cardiac devices with various type and modes and EP Studies & ablations.

**Clinical Electrophysiology Service**

* Introduction to electrophysiology
* Principals of basic electrophysiology including determinants of the normal action potential and normal cardiac rhythm and conduction.
* Genesis of cardiac arrhythmias, including congenital and acquired arrhythmias syndromes and mechanism of action of antiarrhythmic drugs.
* Implantation of cardiac arrhythmia control devices
* Surface ECG interpretation (evaluation of normal and abnormal intervals, recognition of myocardial infarction/ischemia, metabolic and drug effects, conduction disturbances, accessory AV conduction locations, Exercise testing for arrhythmia assessment).
* Non-invasive testing modalities, such as ambulatory EKG recordings, telemetry, event recordings, Tilt-table testing, signal-averaged ECG's, exercise and pharmacological stress testing, heart rate variability, and T wave alternans.
* Bradyarrhythmia (sinus node dysfunction, AV conduction disorders) and tachyarrhythmias (atrial arrhythmias, reentrant arrhythmias, wide complex rhythms).
* Novel arrhythmogenic situations: long QT syndrome, Brugada syndrome, arrhythmogenic right ventricular dysplasia, idiopathic ventricular fibrillation.
* Invasive electrophysiologic evaluation, including principles of stimulation, sinus node function, AV nodal arrhythmias, His-purkinje system, ventricular arrhythmias, as well as ablation therapy for tachyarrhythmias.
* Basic pharmacokinetics and pharmacodynamics of drugs used in electrophysiology.
* Technique of electrical cardioversion and the sedation procedures that accompany this technique
* Indications and basic methods of placing pacemakers and automatic defibrillators.
* Evaluation of patients for syncope and assessment of risks for sudden cardiac death in certain high- risk populations

**Vascular Medicine**

Management and treatment options of various vascular diseases.

* Ordering and interpretation of non-invasive testing
* Peripheral artery disease
* Acute arterial occlusions
* Carotid artery disease
* Cerebrovascular disease
* Aortic aneurysm
* Aortic dissection
* Renal artery stenosis
* Vasculitis
* Basal spasm
* Venous thrombosis
* Venous insufficiency
* Lymphedema
* Indications, strengths, and weakness of the various non-invasive test
* Technical aspects in the performance of modality
* Primary and secondary risks stratification
* Indications and limitations of percutaneous interventions in the treatment of peripheral vascular disease
* Surgical treatment of peripheral vascular disease

**Vascular studies including:**

* Duplex ultrasonography of the veins and arteries of the upper and lower extremities
* Duplex ultrasonography of the aorta and its branches
* Duplex ultrasonography of the carotid arteries
* Physiologic test of the peripheral arteries and veins

**Pre-operative evaluation for non-cardiac surgery**

Trainee in cardiology must acquire an adequate knowledge and skill to evaluate the risk assessment of patients requiring non-cardiac surgical procedures and must be well versed with different diagnostic and evaluation tools used for this purpose, both in elective and emergency conditions.

**Cardiovascular Research:** Includes opportunities for basic cardiac research.

**Preventative Cardiology:** Includes training in the application and implementation of guidelines and strategies for the prevention and early detection of cardiac diseases. Training in skills to manage modifiable risk factors for ischemic heart disease like weight management, dietary habits, exercise ,smoking etc through life style modification.

* Lipid management; Dyslipidemias
* Assessment of cardiovascular risk
* Smoking
* Blood pressure control
* Obesity
* Diabetes mellitus
* Medical therapy for chronic coronary artery disease
* Risks and benefits of cardiac rehabilitation
* Arrhythmia management
* Appropriate management of anticoagulation with the necessary indications Risk factors and educate patients in reducing risk factors:

 **Cardiology Consult Rotation:**

The goal of the inpatient cardiology consult rotation is to train fellows in the

care of inpatients with a variety of cardiovascular conditions and medical comorbidities. Fellows will be expected to lead and educate a team of housestaff and students as well as collaborate with the primary services by communicating their findings in a clear and timely manner. Fellows will also be expected to interact professionally with patients, families, and all members of the cardiology consult team.

* Perform complete history and physical exam, refining aspects of the cardiovascular exam.
* Recognize the differential diagnosis of chest pain and determine appropriate diagnostic workup.
* Integrate information from diagnostic testing to optimize patient care.
* Interpret electrocardiograms accurately, particularly for patients with possible acute coronary syndrome and arrhythmias.
* Formulate differential diagnosis as well as detailed assessment and plan, with attending supervision.
* Review indications for cardiac testing, including stress testing, echocardiography (transthoracic and transesophageal), coronary angiography, CT, and MRI.
* Execute appropriate triage of patients, including identification of high-risk patients that may require immediate intervention or transfer to higher level of care.
* Review evidence and guidelines pertaining to consult questions.
* Recognize own limits of knowledge and seek help appropriately.
* Receive consult requests courteously and render consults in a timely fashion.
* Accept responsibility for communication between teams and prompt documentation.
* Effectively communicate findings in a timely manner both by speaking with a member of the referring team and documenting findings in a progress note.
* Effectively communicate with patients and their families about patient’s condition, plan of care, and prognosis, initially with assistance from the supervising attending.
* Engage in education of residents and students on the consult team as well as the referring teams.
* Formulate differential diagnosis as well as detailed assessment and plan independently.
* Manage patients with a wide variety of cardiovascular conditions including but not limited to possible acute coronary syndrome, congestive heart failure, arrhythmias, syncope, infective endocarditis, valvular heart disease, pericardial disease, and peripheral vascular disease.
* Lead the consult team by assuming primary responsibility for patient care, triaging, communicating findings with referring teams and patients/families, and educating housestaff and students.
* Independently conduct discussions with patients and families regarding patient’s condition, plan of care, and prognosis, and recognize indications for palliative care.
* Participate in successful transition of care from inpatient to outpatient setting.

 **Cardiology Critical Care:**

Training fellows in the care of acute, life-threatening cardiovascular conditions, including but not limited to acute coronary syndromes and associated mechanical complications, acutely decompensated heart failure with and without mechanical circulatory support, circulatory collapse/shock, complex ventricular arrhythmias, unstable conduction disturbances, pericardial tamponade, aortic dissection, and hypertensive emergencies. To manage acutely ill patients, fellows will be able to incorporate clinical, electrocardiographic, hemodynamic, and imaging data. Following is the outline that a fellow should do in this rotation:

-Recognize differential diagnosis of shock and hemodynamic characteristics of each type.

-Interpret hemodynamic data and apply to the management of the patient.

-Understand indications, contraindications, and mechanism of action of vasoactive, inotropic, anticoagulant, antiplatelet, and fibrinolytic medications.

-Manage patients with acute coronary syndromes including associated rhythm disturbances and mechanical complications of acute myocardial infarction, initially with supervision.

-Diagnose and treat hypertensive emergency.

-Diagnose and manage acutely decompensated heart failure, understanding indications for inotropic therapies and mechanical circulatory support, initially with supervision.

-Review types of mechanical circulatory support and their indications/contraindications.

-Diagnose and manage acute, severe valvular heart disease, initially with supervision.

-Diagnose and treat unstable arrhythmias with medications and/or defibrillation, initially with supervision.

-Diagnose pericardial tamponade and recognize indications for pericardiocentesis.

-Review indications for surgery in aortic dissection.

-Recognize indications for oxygen supplementation, endotracheal intubation, and mechanical ventilation.

-Review indications for hemodialysis.

-Apply hypothermia protocols for patients with cardiac arrest.

-Perform central venous catheter insertion, arterial catheter insertion, and emergency echocardiography independently.

-Perform pulmonary artery catheter insertion and temporary transvenous pacemaker implantation under supervision.

-Manage spontaneous or treatment-related acute bleeding complications.

-Participate in family meetings, integrate palliative care, and assist in discussions regarding end-of-life care and transition to hospice.

-Review risk stratification scoring systems for acute coronary syndrome, acutely decompensated heart failure, and pulmonary hypertension.

-Evaluate and manage severe pulmonary hypertension, including indication, contraindications, and mechanism of action of pharmacologic therapies.

-Recognize indications for urgent/emergent valve intervention in patients with severe valvular heart disease.

-Diagnose complications of transcatheter valve interventions and determine appropriate interventions for management.

-Diagnose and manage hemodynamic instability after cardiac surgery.

-Participate in peri-operative care of cardiac transplant and left ventricular assist device recipients as a part of the management team.

-Review treatment of hypotension in specific populations such as cardiogenic shock, hypertrophic obstructive cardiomyopathy, right ventricular infarction, massive pulmonary embolism, severe pulmonary hypertension, pericardial tamponade, and distributive shock.

-Perform pulmonary artery catheter insertion and temporary transvenous pacemaker implantation independently.

-Perform pericardiocentesis in emergency settings.

1. **Pediatric Cardiology:**

The trainee will have four months rotation in Pediatric Cardiology department to get adequate exposure to congenital and acquired pediatric cardiovascular diseases, their presentation, diagnosis and emergency and follow up management with special focus on the following:

* History taking and clinical examination
* Heart Failure
* Cyanotic Congenital Heart Disease {Tetralogy Of Fallot (TOF)}
* Acyanotic Congenital Heart Diseases {Ventricular Septal Defect (VSD), Patent Ductus Arteriosis (PDA), Atrial septal Defects (ASD)}
* Eisenmmenger syndrome
* Rheumatic Fever
* Hypertension
* Viral Myocarditis
* Common Rhythm Disorders {Paroxysmal Atrial Tachycardia (PAT)}
* EKG findings for disease entities with congenital heart disease and their various arrhythmic presentations
* Echocardiographic appearance of normal heart and be able to recognize abnormal appearances of most common congenital heart disease defects
* Clinical findings of congenital heart disease as well as the long-term follow up care required with medical and surgical therapies for this patient population
* Appropriate management techniques for treating patients with congenital heart disease over lifetime follow
1. **Cardiac Surgery Rotation**

The trainee will have two months rotation in cardiovascular surgical department and will observe the cardiovascular surgical procedures for congenital and acquired cardiac problems both in adult and pediatric patients to acquire adequate knowledge and skill to assess indications, contraindications, complications & their management and post surgical management of patients in surgical intensive care (ITC) as well as in cardiac surgical wards and follow-up in OPD.

**13. Clinical Case Conferences and Specialty Lectures**

* Non-invasive Conference covering all aspects of echocardiographic, nuclear, magnetic resonance and CT imaging as well as an Integrated Imaging Conference and an Intra-Operative TEE Conference
* Cardiac CT/MR Conference
* Electrocardiographic/EP Conference
* Cardiology Grand Rounds
* Residents Journal Club
* Cardiology Research Conference
* Cardiac Catheterization Conference
* Interventional Cardiology Conference
* Vascular Medicine Conference

**Research Experience:**

### All residents in the categorical program are required to complete an academic outcomes-based research project during their training. This project can consist of original bench top laboratory research, clinical research or a combination of both. The research work shall be compiled in the form of a thesis which is to be submitted for evaluation by each resident before end of the training. The designated Faculty will organize and mentor the residents through the process, as well as journal clubs to teach critical appraisal of the literature.

**RESEARCH/ THESIS WRITING**

**Research Experience**

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

**Clinical Research**

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

1. Research design

2. Research involving human subjects including informed consent and operations of the Institutional Review Board and ethics of human experimentation

3. Data collection and data analysis

4. Research ethics and honesty

5. Peer review process

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

**Case Studies or Literature Reviews**

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

**Research involving Radioactivity**

Each resident participating in research involving radioactive materials is required to

1. Attend a Radiation Review session

2. Work with an Authorized User and receive appropriate instruction from him/her.

**METHODS OF INSTRUCTION/COURSE CONDUCTION**

As a policy, active participation of students at all levels will be encouraged.

Following teaching modalities will be employed:

1. Lectures

2. Seminar Presentation and Journal Club Presentations

3. Group Discussions

4. Grand Rounds

5. Clinico-pathological Conferences

6. SEQ as assignments on the content areas

7. Skill teaching in ICU, emergency and ward settings

10. Self-study, assignments and use of internet

11. Bedside teaching rounds in ward

12. OPD & Follow up clinics

13. Long and short case presentations

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

**1. Clinical Case Conference**

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

**2. Monthly Resident Meetings:**

Training for MD Cardiology will provide a room for resident meetings/discussions such as:

**a.** Journal Club Meeting

**b.** Core Curriculum Meetings

**c.** Skill Development

***a. Journal Club Meeting***

A resident will be assigned to present, in depth, a research article or topic of his/her choice of actual or potential broad interest and/or application. Two hours per month should be allocated to discussion of any current articles or topics introduced by any participant. Faculty or outside researchers will be invited to present outlines or results of current research activities. The article should be critically evaluated and its applicable results should be highlighted, which can be incorporated in clinical practice. Record of all such articles should be maintained in the relevant department.

***b. Core Curriculum Meetings***

All the core topics of Cardiology should be thoroughly discussed during these sessions. The duration of each session should be at least two hours once a month. Each resident should be given an opportunity to brainstorm all topics included in the course and to generate new ideas regarding the improvement of the course structure

***c. Skill Development***

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

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

1. Residents must develop a comprehensive understanding of the indications, contraindications, limitations, complications, techniques, and interpretation of results of those technical procedures integral to the discipline (mentioned in the Log Book).

2. Residents must acquire knowledge of and skill in educating patients about the technique, rationale and ramifications of procedures and in obtaining procedure-specific informed consent. Faculty supervision of residents in their performance is required, and each resident's experience in such procedures must be documented by the program director.

3. Residents must have instruction in the evaluation of medical literature, clinical epidemiology, clinical study design, relative and absolute risks of disease, medical statistics and medical decision-making.

4. Training must include cultural, social, family, behavioral and economic issues, such as confidentiality of information, indications for life support systems, and allocation of limited resources.

5. Residents must be taught the social and economic impact of their decisions on patients, the primary care physician and society. This can be achieved by attending the bioethics lectures and becoming familiar with Project Professionalism Manual such as that of the American Board of Internal Medicine.

6. Residents should have instruction and experience with patient counseling skills and community education.

7. This training should emphasize effective communication techniques for diverse populations, as well as organizational resources useful for patient and community education.

8. Residents may attend the series of lectures on Nuclear Medicine procedures (radionuclide scanning and localization tests and therapy).

9. Residents are required to assist in the advanced cardiac procedures on a limited basis for exposure to the technique. All trainees should be well versed in the indications for, management of and complications of patients with regard to interventional procedures at the end of the program. Cardiology residents are expected to acquire skill in the performance and interpretation of:

* History and physical examination.
* Cardiac diagnostic procedures.
* Cardiopulmonary resuscitation and advanced cardiac life support
* Complex resuscitative procedures and treatment of complex acute life threatening arrhythmias during the CCU rotation.
* Elective cardioversion. Both inpatient and outpatient cardioversion of atrial fibrillation
* Right and left heart catheterization including coronary arteriography
* Intra-aortic balloon counterpulsation
* Insertion and management of temporary pacemakers
* Programming and follow-up surveillance of permanent pacemakers
* Exercise stress testing
* Echocardiography
* Pericardiocentesis
* Intracardiac electrophysiologic studies.
* Percutaneous transluminal coronary angioplasty and other interventional procedures
* Cardiovascular rehabilitation; prescription of exercise in cardiac patients.

**The cardiology residents are expected to acquire skill in the interpretation of:**

* Chest x-rays. On an individual basis with the attending radiologist as well as part of the didactic program.
* Electrocardiograms. As part of the bimonthly conference schedule ECG's are reviewed. All clinical services require ECG review. The trainee reads
* ECG’s with the attending cardiologist.
* Ambulatory ECG recording
* Radionuclide studies of myocardial function and perfusion. Intensive rotation with didactic and practical interpretation.
* Ongoing research projects. The resident will have regular meetings with the program director to review research in progress.
* Cardiovascular literature.

**LOG BOOK**

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

### E – PORTAL:

### E portal has been provided by RMU for replacement of paper Logbook as part of paperless working. Each Trainee has been given access through RMU site in this regard. Academic activities of the trainees are approved by Supervisors through E portal.