

DM PAEDIATRIC CARDIOLOGY

Program Details

(2024 January Session onwards)
[AC 11.09.2023 (B.1), 113 GB (R28), 58th IB (R31), SCTIMST/DAA/1/53/2023, 22.12.2023]

DETAILS OF THE COURSE FOR DM PEDIATRIC CARDIOLOGY

Aim

The aim of this course is to impart structured training in pediatric cardiology and congenital heart disease, both in clinical care and diagnostic investigations.

Eligibility for DM in Pediatric Cardiology Course

The student should be admitted to the course as a senior resident and DM student in the department of cardiology for a period of three years. The minimum qualification for entering in this course should be MD/DNB in Pediatrics or Internal Medicine from any recognized university/ college in India.

Duration of the course: Three years

Mode of Selection and Minimum Number of Seats

The mode of selection should be as per existing guidelines for other DM courses being conducted by SCTIMST. There would be a written examination by INI-SS. The course will be for three years. The number of seats recommended is one candidate per year. One additional seat may be reserved for a sponsored candidate.

COURSE CURRICULUM DETAILS

Primary areas of training:

1. Antenatal evaluation and counseling for the diagnosis and management of fetal cardiac problems, specifically aided by fetal echocardiography, family screening and genetic studies
2. Neonatal cardiac evaluation and treatment program, where in sick neonates are evaluated and provided with emergency resuscitation and appropriate palliative or definite treatment. This includes preoperative stabilization and management of neonates and infants in the ICU.
3. Postoperative evaluation of newborns and infants including echocardiography and participation in comprehensive rehabilitation of operated children.
4. Pediatric cardiology clinic where in the children and adolescents with heart disease are evaluated and treated
5. Grown up congenital heart disease clinic where in adults with treated pediatric cardiac problems are evaluated and followed up because of the altered natural history
6. Preventive cardiology where primordial prevention of adult onset diseases will be prioritized

This is an interdisciplinary training program with opportunity to interact with the various specialties for antenatal diagnosis, genetic studies, electrophysiologic evaluation, Echo-Doppler and three-dimensional color imaging (trans-thoracic and trans esophageal echocardiography) and correlating the findings with the other modes of imaging like CT angiography, Magnetic resonance studies and angiocardiology. The infrastructure available for basic science studies at the biomedical technology wing and the Rajeev Gandhi institute for Biotechnology and the facilities for community studies at the Achutha Menon Centre for Health Science studies are added advantages.

Learning Objectives

After completing DM (Pediatric Cardiology) course, the student will be able to;

1. Analyze and diagnose pediatric cardiac problems and provide management for these problems in a scientific manner.
2. stabilize newborns and infants with critical congenital heart disease
3. perform diagnostic catheterization in neonates and children and also perform life saving interventions.
4. Perform and interpret a complete echo examination independently in the majority of cases with congenital heart disease. He/she is also expected to learn TEE, Intraoperative TEE and fetal echocardiography.
5. Perform and interpret diagnostic catheterization in adolescents and adults with congenital heart disease and perform therapeutic procedures.
6. Be able to do perioperative epicardial and transesophageal echocardiography in children undergoing cardiac surgery.
7. Be able to read and interpret advanced imaging modalities – cardiac CT and MRI in children with heart disease.
8. Plan and assist in pacemaker implantation; perform and analyze simple electrophysiological studies.
9. Carry out research in pediatric cardiac care in clinical, community and laboratory settings.
10. Assist in establishing centers for pediatric cardiac care.
11. Learn good communication skills and demonstrate compassion towards patients/parents.
12. Learn about the equipments being used in pediatric cardiology, to use these optimally and keep abreast with advances in new technologies.

13. Work as a productive team member in the department in conjunction with Pediatric Cardiology and Pediatric Cardiac Surgery.

14. Constantly update his/ her knowledge through new literature in the specialty.

CLINICAL TRAINING

Proposed Plan for Postings

Over a period of 36 months, the student will be posted in various sections and in other departments relevant to training. The outline is as below;

1. **Outpatient Services:** The resident will attend outpatient services throughout three years and will evaluate both new as well as old cases, initially under the guidance of the faculty member. The student should plan the care and follow up of patients. This would serve the important purpose of acquisition of clinical skills under supervision.
2. **In-patient care:** The student will be posted in the pediatric cardiology ward for a period of at least 6 months, preferably for one year. During this time, he/she is expected to take total care of the admitted children under the supervision of a faculty member. A formal bedside teaching by the consultant would be done at least once a week.
3. **Cardiac Catheterization and Interventions:** The duration of this posting will be for a minimum period of six months. Responsibilities will include preparation of cases and performance of cardiac catheterization under the supervision of a faculty member. He/she will also participate in the interventional procedures. Each case would be presented to the consultant after review and analysis of the data.
4. **Echocardiography:** Since this is a very important diagnostic modality for cardiac disease in pediatric age group, the student is expected to spend six months in echo lab, learning the diagnosis of various simple and complex congenital and acquired heart diseases. A structured training in echocardiography will be provided, mainly through hands on experience. At the end of this posting, the student is expected to perform and interpret a complete echo examination independently in the vast majority of cases with congenital heart disease. He/she is also expected to learn TEE, Intraoperative TEE and fetal echocardiography.
5. **Cardiac Intensive Care:** The student will be directly responsible for all beds in neonatal intensive care unit in the pediatric cardiology ward. He/she needs to be familiar with critical care monitoring, care of ventilated children (in concert with anesthesiologists), performance of bedside invasive procedures like putting in central

- venous and peripheral arterial lines. The consultant would provide direct supervision.
6. **Cardiac surgery:** The student will spend two months in Congenital Heart Surgery division of Cardiovascular and Thoracic Surgery department. The student shall attend cardiac surgery cases in the operation theater, observe preoperative stabilization and postoperative management. The student will observe and participate in intraoperative imaging – epicardial and transesophageal echocardiography. He will also observe cardiopulmonary bypass and extracorporeal membrane oxygenation.
 7. **Neonatology:** The student will be required to attend one month's observership, in the second year of training, at a dedicated Neonatology unit in a government institute.
 8. **Cardiac Imaging:** The student will spend one month in the Department of Interventional Radiology and Imaging Sciences of SCTIMST under the Cardiac Radiology team. The student is required to learn and interpret advanced cardiac imaging modalities in children – cardiac CT, MRI.
 9. **Electrophysiology:** The student should be able to learn about arrhythmias and electrophysiology inclusive of ablation procedures during his/her posting in electrophysiology lab for two months. In addition he/ she would assist in pacemaker implantations in children.
 10. **Adult Cardiology program:** Student will spend three months in various aspects of adult cardiology for orientation to coronary artery disease and other cardiac diseases of adults.
 11. **Other non-invasive Labs:** Posting for brief duration will also be done in Exercise lab, Holter lab.
 12. **Biomedical technology wing:** This is to expose the candidate to the research areas and technology.
 13. **Achutha Menon Centre for Health science:** This is to expose the candidate to public health management as a pediatric cardiologist

Number of procedures necessary during the course:

A log book will be maintained by the student. He/ she is expected to complete minimum number of following procedures during three years training period as detailed below:

- 1) Cardiac Catheterization including interventional procedures; as assistant 200 cases, independent but supervised – 50 cases. Life saving interventions such as balloon atrial septostomy, aortic and pulmonary valve balloon dilation in sick neonates as per the case load.
- 2) Echocardiographic studies–Total-1000 cases, supervised -500, later independent -500.
- 3) Transesophageal echocardiographic studies -100, fetal echocardiographic studies-20.

Rotations in other departments

1. Cardiothoracic Surgical Unit: Cardiac surgical knowledge is an integral part of any successful pediatric cardiac program. The student will be exposed to the details of surgery and intensive care in the postoperative ward for a period of three months, when he/she is posted with cardiothoracic surgical unit.

2. Pediatrics and Neonatology: The student will be posted for one month in Pediatric Intensive Care and for one month in Neonatal Intensive Care. This would expose him/ her to management strategies in the setting of intensive care.

3. Cardiac Radiology and Nuclear cardiology: One month each posting in these departments will help in understanding of Nuclear Cardiology, CT, MRI and other procedures.

Letters will be sent to the heads of the departments for allowing the rotational posting in their respective departments.

Summary of clinical training is tabulated below

Training area	Duration of posting
Outdoor patient care	All through 36 months
In patient care	6 months
Intensive care	3 months
Cardiac catheterization lab	6 months
Echocardiography lab	6 months
Electrophysiology lab	3 months
Adult cardiology	3 months
Other non invasive lab	1 month
Cardiothoracic surgery department	3 months
Pediatrics and neonatology	2 months
Cardiac radiology and Nuclear cardiology	2 month

Grid for postings in various areas

Area of posting	First year	Second year	Third year
OPD (twice a week)	Yes	Yes	yes
Wards	3 mo	3 mo	-
ICU	1 mo	1 mo	1 mo
Cath lab	2 mo	2 mo	2 mo
Echo lab	2 mo	2 mo	2 mo
EP lab	1 mo	2 mo	-

Adult cardiology	1 mo	-	2 mo
Other labs	-	1 mo	-
CTVS	-	1 mo	2 mo
Ped and neonatology	1 mo	-	1 mo
Card radiology and nuclear cardiology	1 mo	-	1 mo
Total	12 months	12 months	11 months

RESEARCH

Thesis: During the first two and a half years of training, the student will complete at least one research project under the supervision of one of the faculty members. It will be mandatory to do the project prospectively and make all efforts to get it published in an indexed journal before final examination. The candidate will make at least three formal presentations to the department, Protocol, mid course progress and final report. Thesis will be submitted six months before the completion of course.

CMEs: The student will be encouraged to attend continuing medical education symposia, workshops and conferences including the annual conference of Pediatric Cardiac Society of India.

Research methodology etc.: The student is expected to attend workshops on various research methodologies and other allied subjects.

EDUCATION AND TEACHING

Learning in DM Pediatric Cardiology will essentially be self-directed and will take place while working in various areas and through interactions in the rounds.

Following minimal formal sessions are recommended to facilitate and supplement efforts of the faculty and students:

1. Daily morning cath meeting to discuss invasive lab patients and problem cases either in the ward or OPD
2. Journal club: once in a week
3. Seminars: twice in a weeks (one long and one short)
4. Clinical case discussion: Once a week
5. Problem oriented case discussion: once in a week
6. Teaching nurses in wards and ICU: Once a week

The skills of each student will form part of the internal assessment.

LIST OF SKILLS

Clinical

- History taking and examination of neonates, infants and children
- Resuscitation of pediatric patients
- Ventilation of patients and knowledge of all modes of ventilation
- Blood sampling: Capillary, arterial and venous
- Insertion of peripheral lines
- Insertion of central lines including radial arterial lines, femoral arterial and venous lines
- Cardiac monitoring of sick patients and knowledge of working of bedside monitors
- Echocardiography including transesophageal echo
- Interpreting echocardiographic images and loops
- Performing cardiac catheterization and angiography
- Hemodynamic data interpretation
- Angiography interpretation
- Performing balloon atrial septostomy and other emergency procedures
- Interpreting CT and MRI images for simple cardiac conditions
- Precautions for asepsis during procedures
- Chest tube insertion
- Knowledge about drugs and their doses
- Enteral and parenteral feeding and nutrition

Education and training

- Teaching skills for presentations, seminars
- Principles of bed side teaching
- Updating of knowledge by literature search etc.
- Teaching of residents and nurses

Research method

Basic Statistics, Framing research question, designing and conducting research studies, analyzing and interpreting data and writing a research paper, Conducting an RCT

Communication skills

- Communication with parents, families and communities with compassion

How to start a pediatric cardiac program

Syllabus: Theory and practice of Pediatric cardiology can be summarized as

Theory: Pediatric cardiology;

1. Fetal cardiac development, genetics, epigenetics and developmental anatomy of congenital heart disease.

2. Fetal, transitional and neonatal circulation and cardiovascular physiology
3. Fetal, neonatal and infant pediatric cardiac diseases
4. Heart diseases in children and adolescents
5. Pediatric cardiac arrhythmias
6. Heart failure
7. Uncommon and emerging cardiac problems
8. Pediatric cardiac imaging
9. Grown up with congenital heart diseases, including exposure to adult cardiology imaging, interventions and intensive care programs
10. Pediatric origin of adult onset diseases and preventive cardiology

Practice of Clinical pediatric cardiology

1. Comprehensive clinical evaluation and management of the subject attending the hospital clinic or emergency for a suspected congenital heart disease or heart disease in the pediatric age group
2. Organizing noninvasive and invasive evaluation and management of an anticipating mother, neonate, infant, toddler, children and adults with suspected cardiac problem which include
 - A) electrocardiography, holter, treadmill studies, tilt table testing and electrophysiologic evaluation of arrhythmias
 - B) fetal echocardiography, and MR evaluation
 - C) Two-dimensional color Doppler and three dimensional trans thoracic and transesophageal echocardiography
 - D) CT MR and angiographic evaluation under sedation and anesthesia as needed
 - E) Shunt quantification, hemodynamic assessment and angiocardiology
 - F) Timing appropriate interventions and surgery
 - G) Intra-operative and post-operative evaluation
 - H) Evaluation of cardiac failure and suitability for re-synchronization and follow up
 - I) Pharmacology and interventional therapeutics of congenital

heart diseases

- J) Specialty clinics to evaluate and optimize the therapeutic plan for cyanotic children and children with complex congenital heart disease for palliative procedures and univentricular circulation
- K) Specialty clinics for specific disorders like rheumatic heart disease, Kawasaki disease, heart failure, hyperlipidemia, heart failure, pulmonary hypertension.

During the first year of the training program the resident will focus more on the applied anatomy, physiology, pathology, pharmacology and instrumentation for understanding the pathophysiology as covered in the standard pediatric cardiology books cited here as the reference books. The foundation thus generated will be assessed by a theory examination

Subsequent clinical work will also be aided by these reference books along with the publications available in standard journals which are accessible through the journal subscriptions of the library or through the library consortiums in India.

DETAILS OF COURSE to be covered:

Cardiac Anatomy

Chamber Anatomy
Classification and Terminology
Cardiac Specimen Examination
Anatomy of the Conduction system

Cardiac Physiology

Fetal physiology
Circulatory Changes at Birth
Neonates and Infants
Children and Adolescents
Blood Pressure
Myocardial Ischemia and Infarction

Development/Components of CVS

Cardiac Embryology
Pericardium
Myocardium
Endocardium
Vessels
Cardiac Neural system

History Taking and Clinical examination

Diagnostic Tools

Roentgenology: interpreting x-rays
Normal and abnormal ECG
Exercise Testing
HUTT
Long Term Monitoring
Introduction to Echocardiography
Advanced Echocardiography: Transesophageal, 3D
Use of Echocardiography in the ICU
Cardiac CT and MRI
Cardiac Radionuclide Imaging
Cardiac Catheterization and Interventions

Pediatric Intensive Care

Preterm babies
Post CPB care
Resuscitation
Mechanical Assist Devices

Molecular Cardiology and Genetics

Understanding Molecular Biology
Basic Genetics
Genetics of CHD

Electrophysiology

Disorders of Cardiac Rhythm/conduction
Syncope and SCD
Cardiac Channelopathies
Arrhythmia recognition
Drugs used for arrhythmias
Electrophysiology and Catheter Ablation
Cardiac Devices

Congenital Cardiac Disorders

Septal Defects

ASD
VSD
AVSD

Anomalies of the Arterial System

PDA
APW
Coronary Arteries
Aortic Root abnormalities and RSOV
Aortic Arch anomalies

Venous/Right Heart anomalies

Pulmonary Venous anomalies

Systemic Venous anomalies
Tricuspid Valve Stenosis and Atresia
Tricuspid Valve Dysplasias, Congenital TR
Ebstein's and Uhl's anomaly
Pulmonic Stenosis
Pulmonary Atresia and Intact Ventricular Septum
Pulmonary Atresia and VSD
TOF with PS and Absent Pul Valve

Left Heart Abnormalities

Cor Triatriatum and Supramitral Ring
Congenital Mitral Valve abnormalities
Aortic Stenosis
Coarctation of Aorta
HLHS

Abnormalities of Great Vessels

Truncus Arteriosus and Hemitruncus
Transposition of Great Arteries
Congenitally Corrected Transposition of Great Arteries
DORV

Abnormalities of AV Connection and Cardiac Malpositions
Isolated Ventricular Inversion
Criss Cross Hearts
Abnormalities of Situs and Cardia
Univentricular Hearts

Cardiomyopathies

Primary Myocardial Diseases
Hypertrophic Cardiomyopathy
Restrictive Cardiomyopathy
Heart and Musculo-Skeletal system

Rheumatic Heart Disease

Epidemiology of RF/RHD
Etiopathogenesis of RF/RHD
Streptococcal Sore Throat
Acute Rheumatic Fever
Valve Lesions in RHD
Medical Management of RHD
Interventional Management in RHD

Acquired Disorders of the Heart

NSAA
Kawasaki's Disease
Tuberculosis and Heart
Infective Endocarditis
Cardiac Trauma

Pericardial Diseases

Acute Pericarditis and Pericardial Effusions
Cardiac Tamponade
CCP
Congenital Disorders of Pericardium

Pulmonary Artery Hypertension

Pulmonary Vasculature
Mechanisms of PAH
Eisenmenger Syndrome
PPH including PPHN
Pulmonary Embolism and DVT
Management of PAH

Interventions in Congenital Heart Diseases

BMV
Balloon dilatation for aortic valve and Coarctation
Balloon dilatation for pulmonary valve and Peripheral PS
Device Closure of Common Defects
Devices and Coils for Uncommon defects

Principles of Cardiac Surgery

Historical Aspects
CPB and Cardioplegia
Valve related surgery
RACHS and Other Principles
Cardiac Transplantation

Adult CHD

Uncorrected Congenital Defects
Corrected and Palliated Defects
Pregnancy and Lactation

Other Special Problems in Children

Chest Pain
Hypertension in Children
Atherosclerosis and Lipid Biology
Management of Hyperlipidemias
CHF in Children
Cardiac and Vascular Tumors
Drugs and toxins
Malnutrition and Obesity
Hematological Aspects of Pediatric Cardiac Defects
Systemic Diseases and the Heart
Neurodevelopmental sequelae of CHD

Final examination

Final assessment will be carried out by two external examiners and two internal examiners. The protocol for evaluation will be on the lines of existing DM cardiology course. Summary of final examination is as below;

Theory papers (3)

Practical exam

Candidate must pass in theory and practical exam independently by obtaining at least 50% marks in each.

Examination format

Theory examination: each paper will carry equal marks

Theory exam will consist of structured essay type of questions.

Theory paper I: Basic sciences as applied to pediatric cardiology and research methodology.

Theory paper II: Clinical, noninvasive and invasive pediatric cardiology.

Theory paper III: Recent advances, epidemiology and community as related to pediatric cardiology.

Practical examination:

Long case: 30% of total marks

Short cases: 2, each for 15% of total marks

Spotters: 20% of total marks

Viva voce: 20% of total marks

ASSESSMENT

Marks will be awarded and the student as per DM/MCh guidelines of the Institute. Candidate must obtain at least 50% marks to pass the examination. 20% of marks will be reserved for internal assessment. Continuous assessment will be done on an ongoing process basis using a log book covering day to day performance of the student.

Internal assessment details:

1. Continuous assessment report by faculty 6 monthly
2. Yearly examination
3. Evaluation of log book every 6 months by faculty
4. Evaluation of thesis and other research activities
5. Evaluation of teaching, presentations, journal club etc.

The degree will be called DM in Paediatric Cardiology.