GuidelinesFor

Competency Based Training Programme

in

Pediatric cardiology

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**SRI AUROBINDO UNIVERSITY**

SAIMS HOSPITAL CAMPUS, Indore Ujjain, State Highway, Bhawrasla, Indore, Madhya Pradesh 453555

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# INTRODUCTION

The specialty of Pediatric Cardiology developed as a Sub-Specialization of Pediatrics and is predominantly concerned with the care of pediatric patients with cardiac problems. Specialty training in Paediatric Cardiology consists of core and higher specialty

training. Core training provides physicians with: the ability to investigate, treat

and diagnose patients with acute and chronic medical symptoms; and with high

quality review skills for managing inpatients and outpatients. Higher specialty

training then builds on these core skills to develop the specific competencies

required to practice independently as a consultant Paediatric Cardiologist.

The most important function of the specialist-training programme is to educate

individuals who will become consultants capable of providing the highest

standard of service to children with cardiac disorders and adolescents and adults

with congenital heart disease.

**PROGRAMME OBJECTIVES**

The education programme in paediatric cardiology aims to produce physicians

who:

• Address all aspects of the healthcare needs of patients and their families

• Communicate effectively with children, families, and colleagues

• Are able to coordinate effectively the work of the paediatric cardiology

team

• Manage time and resources to the benefit of themselves, their patients

and their colleagues .

• Are able to operate as safe independent practitioners whilst recognizing

the limitation of their own expertise and the obligation to seek assistance

of colleagues where appropriate Have acquired and developed team

working and leadership skills

• Work effectively with other health care professionals

• Are able to teach other physicians and health care professionals

• Will be honest and objective when assessing the performance of those

they have supervised and trained

• Develop clinical practice which is based on an analysis of relevant clinical

research and have an understanding of research methodology

• Are aware of current thinking about ethical and legal issues

• Can take advantage of information technology to enhance all aspects of

patient care

• Recognize specific challenges faced by children with heart disease at a

national level and work to partner with government in achieving the

national ideal of ensuring access to pediatric cardiac care to all affected

children.

• Maintain the highest standard in their professional field and show

themselves able to respond constructively to assessments and appraisals

of professional competence and performance .

• Are able to identify and take responsibility for their own educational needs

and the attainment of these needs . Are aware of procedures and able to

take action when things go wrong, both in their own practice and in that of

others

• Work effectively and efficiently in health care organization

• Are able to apply the knowledge of biological and behavioral sciences in

clinical practice

• Apply appropriate knowledge and skill in the diagnosis and management

of children with cardiovascular disorders and adults with congenital heart

disease

• Are competent to perform the core investigations required for the

evaluation of children with cardiovascular disorders and adults with

congenital heart disease.

• Can develop management plans for the whole patient and maintain

knowledge of other areas of paediatrics and adult medicine which impinge

on the specialty of paediatric cardiology.

By the end of specialist training the trainee should have developed competence

in the following:

• Good clinical care

• History, examination, investigations, treatment, note keeping and

correspondence

• Managing chronic disease

• Time management and decision making

• Communication skills

• Maintaining good medical practice

• Maintaining Trust

• Professional behaviour

• Ethics and legal issues

• Patient education and disease prevention

• Working with colleagues

• Teamwork and leadership skills

• Teaching and educational supervision

• Research

• Clinical governance

• Information use and management

• Cross-specialty skills

• Admissions and discharges

• Discharge planning

• Resuscitation

• Nutrition

**Clinical Learning Objectives** By the end of the education programme the

trainee is expected to manage the following clinical problems:

• Cardiovascular collapse in infancy

• Cardiac failure in infants and children

• Cyanosis in the newborn period

• Cyanosis beyond the newborn period

• Evaluation of the child with a cardiac murmur

• Evaluation of children and adolescents with chest pain, palpitations,

presyncope or syncope Patients with acyanotic congenital heart disease

• Left to right shunts

• Duct dependent systemic circulation

• Obstructive left heart lesions

• Acyanotic obstructive right heart lesion

• Patients with cyanotic congenital heart disease

• Duct dependent pulmonary circulation

• Transposition of the great arteries

• Cyanotic congenital heart disease with high pulmonary flow

• Complex cyanotic congenital heart disease Pulmonary hypertension

• Fontan circulation

• Inflammatory cardiovascular disease including Kawasaki Disease

• Rheumatic Heart Disease

• Cardiomyopathy and myocarditis

• Prevention and management of infective endocarditis

• Cardiovascular abnormalities in neonatal intensive care

• Cardiovascular evaluation of children with genetic disorders and

syndromes

• Cardiac evaluation of the child with stridor

• Detection and management of fetal cardiac abnormalities

• Adolescent and adult congenital heart disease

• Arrhythmias

• Nutrition and growth in congenital heart disease

• Assessment of children prior to cardiac surgery

• Care of children following cardiac surgery

• Assessment of children with cardiac disease prior to non-cardiac surgery

• Management of critically ill children with cardiovascular compromise

**ELIGIBILITY CRITERIA FOR ADMISSIONS TO THE PROGRAMME**

## PDF Pediatric Cardiology courses:

* 1. Any medical graduate with DNB/ MD Pediatrics qualification , who has qualified the Entrance Examination conducted by SRI AUROBINDO UNIVERSITY and fulfill the eligibility criteria for admission to PDCC
  2. Admission to 1year PDF Pediatric cardiology course is only through Entrance Examination conducted by SRI AUROBINDO UNIVERSITY and Centralized Merit Based Counseling conducted by SRI AUROBINDO UNIVERSITY as prescribed guidelines.

# Duration of Course:1 Year

Every candidate admitted to the training programme shall pursue a regular

course of study (on whole time basis) in the concerned recognized institution

under the guidance of recognized post graduate teacher for assigned period of

the course.

**TEACHING AND TRAINING ACTIVITIES**

The fundamental components of the teaching programme should include:

1. Case presentations & discussion- once a week

2. Seminar – Once a week

3. Journal club- Once a week

4. Grand round presentation (by rotation departments and subspecialties)-

once a week

5. Faculty lecture teaching- once a month

6. Clinical Audit-Once a Month

7. A poster and have one oral presentation at least once during their training

period in a recognized conference.

The rounds should include bedside sessions, file rounds & documentation of case

history and examination, progress notes, round discussions, investigations and

management plan) interesting and difficult case unit discussions.

The training program would focus on knowledge, skills and attitudes (behavior), all

essential components of education. It is being divided into theoretical, clinical and

practical in all aspects of the delivery of the rehabilitative care, including methodology of

research and teaching.

**Theoretical:** The theoretical knowledge would be imparted to the candidates through

discussions, journal clubs, symposia and seminars. The students are exposed to recent

advances through discussions in journal clubs. These are considered necessary in view

of an inadequate exposure to the subject in the undergraduate curriculum.

**Symposia:** Trainees would be required to present a minimum of 20 topics based on the

curriculum in a period of three years to the combined class of teachers and students. A

free discussion would be encouraged in these symposia. The topics of the symposia

would be given to the trainees with the dates for presentation.

**Clinical:** The trainee would be attached to a faculty member to be able to pick up

methods of history taking, examination, prescription writing and management in

rehabilitation practice.

**Bedside:** The trainee would work up cases, learn management of cases by discussion

with faculty of the department.

**Journal Clubs:** This would be a weekly academic exercise. A list of suggested Journals

is given towards the end of this document. The candidate would summarize and discuss

the scientific article critically. A faculty member will suggest the article and moderate the

discussion, with participation by other faculty members and resident doctors. The

contributions made by the article in furtherance of the scientific knowledge and

limitations, if any, will be highlighted.

**Research:** The student would carry out the research project and write a thesis/

dissertation in accordance with NBE guidelines. He/ she would also be given exposure

to partake in the research projects going on in the departments to learn their planning,

methodology and execution so as to learn various aspects of research.

**SYLLABUS**

**Cardiology**

**I.** Pediatric Cardiovascular Epidemiology:

• Disease burden and health system challenges associated with pediatric

heart disease in India

• Relative importance of pediatric heart disease in the context of other

pediatric health priorities

A detailed study of available literature published from the country on:

Congenital Heart Disease

Rheumatic Heart Disease

Childhood obesity and lifestyle related heart disease

II. **Cardiopulmonary Structure, Development, and Function**

• Cardiovascular anatomy and ultrastructure

• Gross cardiovascular anatomy. Understand the principles of segmental

anatomy

• Know the normal anatomy of the systemic veins and important variations

• Know the normal anatomy of the atria, atrial septum, appendages, and

relationship to thoracic structures

• Know the anatomic features of the atrioventricular valves and

atrioventricular orientation (concordance/discordance)

• Know the normal anatomical features of the right ventricle, left ventricle,

and the inter-ventricular septum, and ventriculo-arterial orientation

(concordance/discordance)

• Know the anatomic features of semilunar valves, including spatial

relationships to each other and the ventricular outlets

• Know the anatomical features of the pulmonary arteries, pulmonary

vasculature and orientation to thoracic structures (eg, bronchi)

• Know the normal structure and anatomic relationships of pulmonary veins

• Know the normal anatomic features of the coronary arteries

• Know the normal anatomy of the aorta and it's orientation to thoracic

structures

• Know the normal anatomy of the systemic arteries and important

variations

• Understand the relationship between the left recurrent laryngeal nerve

and structures within the thorax

**2 Ultrastructure**

**A.** Know the ultrastructure of cardiac myocyte along with developmental aspects of

the myofibrils, contractile proteins, transverse tubular system, sarcoplasmic

reticulum, intercalated disc, nucleus and perinuclear region, mitochondria, and

glycogen stores

**B**. Normal embryology and development of myocardial structure and function

• Know the important components (tissues) of the primitive cardiac tube and

the origins of cardiac segments including origin of the primary and

secondary heart fields

• Understand looping of the primitive cardiac tube under normal and

abnormal conditions

• Know the normal development of the peripheral vasculature

• Describe normal embryologic sequence in the development of pulmonary

veins, including the fate of the common pulmonary vein

• Know the normal development of the bulbus cordis and truncus arteriosus

• Know the embryologic basis for atrioventricular connections

• Know the development of the six aortic arches (eg, sequence, timing,

regressions)

• Know the normal development of the various cardiovascular structures

(eg, semilunar valves, aortic pulmonary septum, division of truncus)

• Understand the contribution of neural crest tissue to normal cono - truncal

development

• Understand the molecular regulation of cardiac determination and

differentiation

• Identify the molecular pathways that determine visceral situs

• Know the origins of the epicardium and its importance for coronary, valvar,

and fibrous development of the heart

• Know the normal development of the conduction system

• Know the normal developmental sequence of the pulmonary vasculature

• Know the normal developmental sequence of the coronary vasculature

**C**. Cardiovascular physiology

**1.** Embryo and fetus

• Know the distribution of cardiac output to the various circulations during

normal and abnormal conditions (eg, pulmonary, coronary, central

nervous system, ventricular, peripheral vascular beds, placenta)

• Understand how blood flow patterns in cardiovascular structures, including

fetal structures, may be influenced by congenital anomalies

• Understand regulation of circulation in the embryo and fetus

• Understand the fetal circulation and its clinical correlates with findings on

fetal echocardiography

**2**. Postnatal circulation

• Understand the physiologic aspects of postnatal heart rate, preload

effects, afterload effects, and contractility, and how these factors modulate

cardiac output

• Know the postnatal changes in pulmonary and systemic circulations after

birth and how they may be influenced by congenital defects (eg, left-toright

shunts, hypoxemia, obstructive lesions)

**3**. Cardiac mechanics

• Understand the interaction of contractile and regulatory protein in

determining sarcomere function

• Understand the role of calcium ions in the contractile process and

dynamics of calcium ion movement/storage

• Understand the process of excitation-contraction coupling

• Understand the concepts and variation of length-tension

relationships

• Understand ventricular pressure-volume function loops

• Understand the concept of inter-ventricular interaction

• Understand the role of neural-humoral factors on control of the

cardiovascular system

• Understand the role of the thyroid in modulating control of the

cardiovascular system

• Understand the role of baroreceptors in control of the

cardiovascular system

• Understand the role of chemoreceptors in control of the

cardiovascular system

• Understand cellular responses and their interactions with drugs,

blood gases, and pH

• Know the molecular events occurring during the cardiac cycle

• Understand the role of the pericardium on impairment of cardiac

function

• Understand myocardial metabolism and the impact of hormonal

influences, hypoxia, ischemia, and age

• Know how hemodynamic loads affect myocardial gene expression

• Recognize the acute effects and compensatory responses of

ventricular dilatation and hypertrophy on cardiac function

• Understand the atrial contribution of ventricular function

• Know the age-related differences in function of sarcolemma and

sarcoplasmic reticulum

• Know the effects of acidemia and hypoxemia on contractility

• Recognize factors involved in the myocardial oxygen supplydemand

ratio

• Know how hemodynamic loads affect vascular gene expression

• Understand cardiac receptor function and its response to drugs,

blood gases, and pH

• Understand the determinants of contractions of isolated cardiac

myocytes and papillary muscle

**4.** Vascular physiology

• Understand the concept of auto regulation of regional blood flow,

including age-related differences

• Know the role of inflammatory mediators and of endothelium in

control of regional circulation

• Understand the mechanisms that regulate coronary circulation,

including exercise and hypoxemia

• Understand the mechanisms that regulate cerebral circulation,

including pH, PCO2, PO2, and perfusion

• Understand the influence of pH, PO2, and PCO2 on pulmonary

circulation

• Understand the role of endothelium on pulmonary circulation

• Understand the mechanisms involved in vasodilation in pulmonary

and systemic vascular beds

• Identify the factors influencing tone in the pulmonary vascular bed

• Understand how vascular smooth muscle is maintained in a dilated

state

• Understand the Poiseuille equation and the effect of changing the

caliber of the resistance vessels

• Know the effects of asphyxia on regional circulatory functions,

particularly heart, brain, kidneys, and lung

• Know the effects of changes in renal blood flow on renal function

and body fluids

• Understand the mechanisms that regulate skeletal muscle blood

flow during exercise

• .Conduction system, including electrophysiology

**5.** Developmental aspects

• Recognize the age-dependent nature of structure and function of

the conduction system

**6** . Anatomic aspects

• Know anatomic basis and features of the conduction system

• Know the conduction system abnormalities associated with cardiac

anomalies

**7**. Electrophysiologic aspects

• Understand the structure and function of ion channels in myocardial tissue

• Understand the components of the myocardial cell action potential

• Understand the ionic basis of cardiac automaticity

• Know the electrophysiologic characteristics of the atrial, atrioventricular,

and ventricular conduction system

**8**. Respiratory physiology and ventilation

**A** Structure

• Understand the age-related (including prematurity) effects on

airway physiology, including airway resistance and ventilation

pattern

• Recognize the effects of upper airway obstruction on

cardiopulmonary physiology

• Recognize effects of large airway obstruction on cardiopulmonary

physiology

• Recognize effects of cardiomegaly and pulmonary vascular

anatomy on large airway function

• Know the pathologic changes that occur in the small airways in

various cardiopulmonary conditions

• Recognize potential effects of cardiomegaly and pulmonary

vasculature on small airway function

• Know the pathologic changes that occur in the alveoli in various

cardiopulmonary conditions, including congestive heart failure and

alterations in pulmonary blood flow

**B.** Ventilation

• Identify and know importance of variations in pulmonary pressurevolume

relationships

• Understand the effects of FIO2 on nitrogen clearance, regional

blood flow, and arterial blood gas tensions

• Know the importance of normal lung inflation and deflation on

cardiovascular physiology

• Recognize the influence of cardiovascular disease on lung volume,

tidal volume, and respiratory rate

**C**. Oxygen delivery

• Understand the determinants of gas transfer from the airway to

arterial blood

• Know factors influencing the amount of dissolved oxygen in blood

• Understand the differences between adult and fetal hemoglobin

• Understand the effects of a change in arterial oxygen tension in the

oxy-hemoglobin dissociation curve, and mixed venous oxygen

content

• Apply the principles of ventilation-perfusion balance and mismatch

in the evaluation of a patient with cardiovascular disease

**D**. Acid-base balance

• Know how to recognize acid-base abnormalities, including

respiratory acidosis and alkalosis and metabolic acidosis and

alkalosis

• Identify the causes of acid-base abnormalities, including respiratory

acidosis and alkalosis and metabolic acidosis and alkalosis

• Know methods for correction of acid-base abnormalities, including

respiratory alkalosis and acidosis and metabolic acidosis and

alkalosis

**E**. Blood gas exchange

• Understand the effects of ischemia on O2 and CO2 exchange between

blood and tissue

• Understand the effects of pH, hypoxemia, and hypercarbia on gas

exchange between blood and tissue

• Know the effects of hypoxemia on ventilatory function and tissue

metabolism

**F**. Mechanism of breathing

• Understand the possible physiologic effects of chest wall

abnormality

• Understand the effects of dynamic compression of airways

• Recognize the effect of respiratory effort on caloric consumption

**G**. Respiratory physiology at altitude

• Recognize the effects of acute and chronic exposure to high

altitude on oxygen delivery

• Know the effects of altitude on cardiovascular function

**H** . Effects of mechanical ventilation on CV performance

• Understand the effects of positive end-expiratory pressure and

inspiratory pressures on cardiac output and their influence on right

and left ventricular function

• Understand appropriate use of mechanical ventilation

• Know the general principles of how the mode of ventilation affects

cardiac output

**Pharmacology**

**A**. **Pharmacologic basis for therapy of cardiovascular disease**

• Understand the principles of pharmacokinetics, including drug absorption,

distribution, biotransformation, and excretion

• Understand the principles of pharmacodynamics, including the loci of drug

actions, role of receptors, and dose-response relationships

• Understand drug-drug interactions, adverse reactions, and off-target

effects

• Understand the principles of maternal-fetal pharmacodynamics and

pharmacokinetics

• Understand the basic principles of developmental pharmacology

• Understand the role of pharmacogenomics in drug response

• Understand the principles involved in clinical trials and drug regulation and

development

**B. Antiarrhythmic drugs**

1. Class I antiarrhythmic drugs :

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of Class I antiarrhythmic drugs

• Know the mechanism of action for Class I antiarrhythmic drugs

• Identify indications for Class I antiarrhythmic drugs

• Identify contraindications for Class I antiarrhythmic drugs

• Plan therapy including appropriate dose and monitoring for Class I

antiarrhythmic drugs

• Recognize the drug adverse effects and toxicity of Class I

antiarrhythmic drugs

• Recognize potential drug-drug interactions for Class I

antiarrhythmic drugs

2. Class II antiarrhythmic drugs :

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of Class II antiarrhythmic drugs

• Know the mechanism of action for Class II antiarrhythmic drugs

• Identify Indications for Class II antiarrhythmic drugs

• Identify contraindications for Class II antiarrhythmic drugs

• Plan therapy including appropriate dose and monitoring for Class II

antiarrhythmic drugs

• Recognize the drug adverse effects and toxicity of Class II

antiarrhythmic drugs

• Recognize potential drug-drug interactions for Class II

antiarrhythmic drugs

3. Class III drugs :

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of Class III antiarrhythmic drugs

• Know the mechanism of action for Class III antiarrhythmic drugs

• Identify indications for Class III antiarrhythmic drugs

• Identify contraindications for Class III antiarrhythmic drugs

• Plan therapy including appropriate dose and monitoring for Class III

antiarrhythmic drugs

• Recognize the drug adverse effects and toxicity of Class III

antiarrhythmics

• Recognize potential drug-drug interactions for Class III

antiarrhythmic drugs

4. Class IV antiarrhythmic drugs :

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of Class IV antiarrhythmic drugs

• Know the mechanism of action for Class IV antiarrhythmic drugs

• Identify indications for Class IV antiarrhythmic drugs

• Identify contraindications for Class IV antiarrhythmic drugs

• Plan therapy including appropriate dose and monitoring for Class IV

antiarrhythmic drugs

• Recognize the drug adverse effects and toxicity of Class IV

antiarrhythmics

• Recognize potential drug-drug interactions for Class IV

antiarrhythmic drugs

5. Adenosine :

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of adenosine

• Know the mechanism of action for adenosine

• Identify indications for adenosine

• Identify contraindications for adenosine

• Plan therapy including appropriate dose and monitoring for

adenosine

• Recognize the drug adverse effects and toxicity of adenosine

• Recognize potential drug-drug interactions for adenosine

**C**. **Inotropic agents**

1. Digitalis and ATPase inhibitors

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of digitalis and ATPase inhibitors

• Know the mechanism of action for digitalis and ATPase inhibitors

• Identify indications for digitalis and ATPase inhibitors

• Identify contraindications for digitalis and ATPase inhibitors

• Plan therapy including appropriate dose and monitoring for digitalis

and ATPase inhibitors

• Recognize the drug adverse effects and toxicity of digitalis and

ATPase inhibitors

• Recognize potential drug-drug interactions for digitalis and ATPase

inhibitors

2. Catecholamines

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of catecholamines

• Know the mechanism of action for catecholamines

• Identify indications for catecholamines

• Identify contraindications for catecholamines

• Plan therapy including appropriate dose and monitoring for

catecholamines

• Recognize the drug adverse effects and toxicity of catecholamines

• Recognize potential drug-drug interactions for catecholamines

3. Phosphodiesterase inhibitors

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of phosphodiesterase inhibitors

• Know the mechanism of action for phosphodiesterase inhibitors

• Identify indications for phosphodiesterase inhibitors

• Identify contraindications for phosphodiesterase inhibitors

• Plan therapy including appropriate dose and monitoring for

phosphodiesterase inhibitors

• Recognize the drug adverse effects and toxicity of

phosphodiesterase inhibitors

• Recognize potential drug-drug interactions for phosphodiesterase

inhibitors

4. Calcium sensitizers

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of calcium sensitizers

• Know the mechanism of action for calcium sensitizers

• Identify indications for calcium sensitizers

• Identify contraindications for calcium sensitizers

• Plan therapy including appropriate dose and monitoring for calcium

sensitizers

• Recognize the drug adverse effects and toxicity of calcium

sensitizers

• Recognize potential drug-drug interactions for calcium sensitizers

**D. Systemic vasoactive agents**

1. Nitrates

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of nitrates

• Know the mechanism of action for nitrates

• Identify indications for nitrates

• Identify contraindications for nitrates

• Plan therapy including appropriate dose and monitoring for nitrates

• Recognize the drug adverse effects and toxicity of nitrates

• Recognize potential drug-drug interactions for nitrates

2. Calcium channel antagonists

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of calcium channel antagonists

• Know the mechanism of action for calcium channel antagonists

• Identify indications for calcium channel antagonists

• Identify contraindications for calcium channel antagonists

• Plan therapy including appropriate dose and monitoring for calcium

channel antagonists

• Recognize the drug adverse effects and toxicity of calcium channel

antagonists

• Recognize potential drug-drug interactions for calcium channel

antagonists

3. Angiotensin-converting enzyme (ACE) inhibitors

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of ACE inhibitors

• Know the mechanism of action for ACE Inhibitors

• Identify indications for ACE inhibitors

• Identify contraindications for ACE inhibitors

• Plan therapy including appropriate dose and monitoring for ACE inhibitors

4. Beta-adrenergic blocking drugs

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of ?-adrenergic blocking drugs

• Know the mechanism of action for ?-adrenergic blocking drugs

• Identify indications for ?-adrenergic blocking drugs

• Identify contraindications for ?-adrenergic blocking drugs

• Plan therapy including appropriate dose and monitoring for ?-

adrenergic blocking drugs

• Recognize the drug adverse effects and toxicity of ?-adrenergic

blocking drugs

• Recognize potential drug-drug interactions for ?-adrenergic

blocking drugs

5. Angiotensin-receptor blockers (ARBs)

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of ARBs

• Know the mechanism of action for ARBs

• Identify indications for ARBs

• Identify contraindications for ARBs

• Plan therapy including appropriate dose and monitoring for ARBs

• Recognize the drug adverse effects and toxicity of ARBs

• Recognize potential drug-drug interactions for ARBs

6. Fenoldopam

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of fenoldopam

• Know the mechanism of action for fenoldopam

• Identify indications for fenoldopam

• Identify contraindications for fenoldopam

• Plan therapy including appropriate dose and monitoring for

fenoldopam

• Recognize the drug adverse effects and toxicity of fenoldopam

• Recognize potential drug-drug interactions for fenoldopam

7. Vasopressin

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of vasopressin

• Know the mechanism of action for vasopressin

• Identify indications for vasopressin

• Identify contraindications for vasopressin

• Plan therapy including appropriate dose and monitoring for

vasopressin

• Recognize the drug adverse effects and toxicity of vasopressin

• Recognize potential drug-drug interactions for vasopressin

**E. Pulmonary vasoactive agents**

1. Prostacyclin, epoprostenol, sildenafil, bosentan, etc.

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of pulmonary vasodilators

• Know the mechanism of action for pulmonary vasodilators

• Identify indications for pulmonary vasodilators

• Identify contraindications for pulmonary vasodilators

• Plan therapy including appropriate dose and monitoring for

pulmonary vasodilators

• Recognize the drug adverse effects and toxicity of pulmonary

vasodilators

• Recognize potential drug-drug interactions for pulmonary

vasodilators

**F. Diuretics**

1. Loop diuretics

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of loop diuretics

• Know the mechanism of action for loop diuretics

• Identify indications for loop diuretics

• Identify contraindications for loop diuretics

• Plan therapy including appropriate dose and monitoring for loop

diuretics

• Recognize the drug adverse effects and toxicity of loop diuretics

• Recognize potential drug-drug interactions for loop diuretics

2. Thiazides

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of thiazides

• Know the mechanism of action for thiazides

• Identify indications for thiazides

• Identify contraindications for thiazides

• Plan therapy including appropriate dose and monitoring for thiazides

• Recognize the drug adverse effects and toxicity of thiazides

• Recognize potential drug-drug interactions for thiazides

3. Carbonic anhydrase inhibitors

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of carbonic anhydrase inhibitors

• Know the mechanism of action for carbonic anhydrase inhibitors

• Identify indications for carbonic anhydrase inhibitors

• Identify contraindications for carbonic anhydrase inhibitors

• Plan therapy including appropriate dose and monitoring for

carbonic anhydrase inhibitors

• Recognize the drug adverse effects and toxicity of carbonic

anhydrase inhibitors

• Recognize potential drug-drug interactions for carbonic anhydrase

inhibitors

4. Potassium-sparing diuretics

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of potassium-sparing diuretics

• Know the mechanism of action for potassium-sparing diuretics

• Identify indications for potassium-sparing diuretics

• Identify contraindications for potassium-sparing diuretics

• Plan therapy including appropriate dose and monitoring for

potassium-sparing diuretics

• Recognize the drug adverse effects and toxicity of potassiumsparing

diuretics

• Recognize potential drug-drug interactions for potassium-sparing

diuretics

5. B-type natriuretic peptides

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of b-type natriuretic peptides

• Know the mechanism of action for b-type natriuretic peptides

• Identify indications for b-type natriuretic peptides

• Identify contraindications for b-type natriuretic peptides

• Plan therapy including appropriate dose and monitoring for b-type

natriuretic peptides

• Recognize the drug adverse effects and toxicity of b-type natriuretic

peptides

• Recognize potential drug-drug interactions for b-type natriuretic

peptides

**G. Anti-inflammatory agents**

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of anti-inflammatory agents

• Know the mechanism of action of anti-inflammatory agents

• Identify indications for anti-inflammatory agents

• Identify contraindications for anti-inflammatory agents

• Plan therapy including appropriate dose and monitoring for antiinflammatory

agents

• Recognize the drug adverse effects and toxicity of anti-inflammatory

agents

• Recognize potential drug-drug interactions for anti-inflammatory agents

**H. Antiplatelet/anticoagulant therapy**

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of antithrombic/anticoagulant agents

• Know the mechanism of action for antithrombic/anticoagulant agents

• Identify indications for antithrombic/anticoagulant agents

• Identify contraindications for antithrombic/anticoagulant agents

• Plan therapy including appropriate dose and monitoring for

antithrombic/anticoagulant agents

• Recognize the drug adverse effects and toxicity of

antithrombic/anticoagulant agents

• Recognize potential drug-drug interactions for antithrombic/anticoagulant

agents

**I. Lipid-lowering drugs**

1. Bile acid sequestrants

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of lipid-reducing agents

• Know the mechanism of action for lipid-reducing agents

• Identify indications for lipid-reducing agents

• Identify contraindications for lipid-reducing agents

• Plan therapy including appropriate dose and monitoring for lipid-reducing

agents

• Recognize the drug adverse effects and toxicity of lipid-reducing agents

• Recognize potential drug-drug interactions for lipid-reducing agents

2. HMG CoA reductase inhibitors

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of HMG CoA reductase inhibitors

• Know the mechanism of action for HMG CoA reductase inhibitors

• Identify indications for HMG CoA reductase inhibitors

• Identify contraindications for HMG CoA reductase inhibitors

• Plan therapy including appropriate dose and monitoring for HMG CoA

reductase inhibitors

• Recognize the drug adverse effects and toxicity of HMG CoA reductase

inhibitors

• Recognize potential drug-drug interactions for HMG CoA reductase

inhibitors

3. Glycoprotein IIb/IIIa inhibitors

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of glycoprotein IIb/IIIa inhibitors

• Know the mechanism of action for glycoprotein IIb/IIIa inhibitors

• Identify indications for glycoprotein IIb/IIIa inhibitors

• Identify contraindications for glycoprotein IIb/IIIa inhibitors

• Plan therapy including appropriate dose and monitoring for glycoprotein

IIb/IIIa inhibitors

• Recognize the drug adverse effects and toxicity of glycoprotein IIb/IIIa

inhibitors

• Recognize potential drug-drug interactions for glycoprotein IIb/IIIa

inhibitors

**J. Ductal arteriosus drugs**

1. Prostaglandins

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of prostaglandin E (PGE)

• Know the mechanism of action for PGE

• Identify indications for PGE

• Identify contraindications for PGE

• Plan therapy including appropriate dose and monitoring for PGE

• Recognize the drug adverse effects and toxicity of PGE

• Recognize potential drug-drug interactions for PGE

2. Indomethacin and ibuprofen

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of indomethacin/ibuprofen

• Know the mechanism of action for indomethacin/ibuprofen

• Identify indications for indomethacin/ibuprofen

• Identify contraindications for indomethacin/ibuprofen

• Plan therapy including appropriate dose and monitoring for

indomethacin/ibuprofen

• Recognize the drug adverse effects and toxicity of

indomethacin/ibuprofen

• Recognize potential drug-drug interactions for

indomethacin/ibuprofen

**K. Specific sedative, hypnotic, and analgesic drugs**

1. Barbiturates

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of barbiturates

• Know the mechanism of action of barbiturates

• Identify indications for barbiturates

• Identify contraindications for barbiturates

• Plan therapy including appropriate dose and monitoring for

barbiturates

• Recognize the drug adverse effects and toxicity of barbiturates

• Recognize potential drug-drug interactions for barbiturates

2. Benzodiazepines and antagonists (eg, diazepam, midazolam, flumazenil)

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of benzodiazepines and antagonists

• Know the mechanism of action for benzodiazepines and

antagonists

• Identify indications for benzodiazepines and antagonists

• Identify contraindications for benzodiazepines and antagonists

• Plan therapy including appropriate dose and monitoring for

benzodiazepines and antagonists

• Recognize the drug adverse effects and toxicity of benzodiazepines

and antagonists

• Recognize potential drug-drug interactions for benzodiazepines and

antagonists

3. Non-barbiturates/non-benzodiazepines (eg, etomidate, ketamine)

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of non-barbiturate/non-benzodiazepine agents

• Know the mechanism of action for non-barbiturate/nonbenzodiazepine

agents

• Identify indications for non-barbiturate/non-benzodiazepine agents

• Identify contraindications for non-barbiturate/non-benzodiazepine

agents

• Plan therapy including appropriate dose and monitoring for nonbarbiturate/

non-benzodiazepine agents

• Recognize the drug adverse effects and toxicity of nonbarbiturate/

non-benzodiazepine agents

• Recognize potential drug-drug interactions for non-barbiturate/nonbenzodiazepine

agents

4. Opioids (eg, morphine, fentanyl, meperidine, sufentanil, methadone)

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of opioids

• Know the mechanism of action for opioids

• Identify indications for opioids

• Identify contraindications for opioids

• Plan therapy including appropriate dose and monitoring for opioids

• Recognize the drug adverse effects and toxicity of opioids

• Recognize potential drug-drug interactions for opioids

5. Psychotropic drugs

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of psychotropic drugs

• Know the mechanism of action for psychotropic drugs

• Identify indications for psychotropic drugs

• Identify contraindications for psychotropic drugs

• Plan therapy including appropriate dose and monitoring for

psychotropic drugs

• Recognize the drug adverse effects and toxicity of psychotropic

drugs

• Recognize potential drug-drug interactions for psychotropic drugs

6. Local anesthetics (eg, lidocaine, mepivacaine)

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of local anesthetics

• Know the mechanism of action for local anesthetics

• Identify indications for local anesthetics

• Identify contraindications for local anesthetics

• Plan therapy including appropriate dose and monitoring for local

anesthetics

• Recognize the drug adverse effects and toxicity of local anesthetics

• Recognize potential drug-drug interactions for local anesthetics

**L. Anti-cholinergic drugs**

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of anti-cholinergic drugs

• Know the mechanism of action for anti-cholinergic drugs

• Identify indications for anti-cholinergic drugs

• Identify contraindications for anti-cholinergic drugs

• Plan therapy including appropriate dose and monitoring for anti-cholinergic

drugs

• Recognize the drug adverse effects and toxicity of anti-cholinergic drugs

• Recognize potential drug-drug interactions for anti-cholinergic drugs

**M. Neuromuscular blocking agents**

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of neuromuscular blocking drugs

• Know the mechanism of action for neuromuscular blocking drugs

• Identify indications for neuromuscular blocking drugs

• Identify contraindications for neuromuscular blocking drugs

• Plan therapy including appropriate dose and monitoring for neuromuscular

blocking drugs

• Recognize the drug adverse effects and toxicity of neuromuscular blocking

drugs

• Recognize potential drug-drug interactions for neuromuscular blocking

drugs

**N. Inhalation anesthetics**

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of inhalation anesthetics

• Know the mechanism of action for inhalation anesthetics

• Identify indications for inhalation anesthetics

• Identify contraindications for inhalation anesthetics

• Plan therapy including appropriate dose and monitoring for inhalation

anesthetics

• Recognize the drug adverse effects and toxicity of inhalation anesthetics

• Recognize potential drug-drug interactions for inhalation anesthetics

**O. Antireflux drugs**

• Understand the cardiovascular effects of antireflux drugs, including

contraindications and interactions with other drugs

• Know the mechanism of action for antireflux drugs

• Identify indications for antireflux drugs

• Identify contraindications for antireflux drugs

• Plan therapy including appropriate dose and monitoring for

antireflux drugs

• Recognize the drug adverse effects and toxicity of antireflux drugs

• Recognize potential drug-drug interactions for antireflux drugs

**P. Enzyme replacement therapy for Pompe, Fabry, Hurler**

• Know the pharmacologic effects (pharmacokinetics and

pharmacodynamics) of enzyme replacement therapy

• Know the mechanism of action for enzyme replacement therapy

• Identify indications for enzyme replacement therapy

• Identify contraindications for enzyme replacement therapy

• Plan therapy including appropriate dose and monitoring for enzyme

replacement therapy

• Recognize the drug adverse effects and toxicity of enzyme replacement

therapy

• Recognize potential drug-drug interactions for enzyme replacement

therapy

**Q. Cardiovascular effects of drug abuse**

• Recognize and manage the cardiovascular effects of drug abuse (eg,

cocaine, diet pills, hallucinogens, inhalants, stimulants, anabolic steroids)

**Cardiovascular Examination, Principles, and Application of Cardiac**

**Diagnostics**

**A. Physical examination**

1. Heart rate

• Know the age-related normal measurements of heart rate associated with

disease states and medications

• Understand alterations in heart rate and types of rhythm associated with

disease states and medications

2. Vasculature including arterial and venous pulses, venous congestion, and

blood pressure

• Know significance of differences in pulse amplitude between extremities

• Understand the physiology of paradoxical pulse

• Understand the significance of a widened pulse pressure

• Know the age-related changes in blood pressure values

• Know the different methods of determination of blood pressure and the

potential associated artifacts

• Understand the physiologic events related to the jugular venous pulse and

causes for variation

• Know the principles that underlie the assessment of perfusion (eg,

temperature, capillary refilling, color)

• Recognize the clinical signs of systemic venous congestion and know the

significance of peripheral edema in patients with cardiac disease

3. Murmurs

• Understand the physical basis of murmurs, thrills, and ventricular heaves

• Know characteristics of normal and abnormal heart sounds with respect to

physiologic events and timing in the cardiac cycle

• Recognize the characteristics of the various types of functional

("innocent") murmurs

• Understand the significance of localization and transmission of cardiac

murmurs

• Know how to interpret extracardiac bruits

• Understand the significance of friction rubs

• Know the various characteristics of pathologic murmurs, clicks, and

cardiac sounds.

• Interpret clinical physical examination data influenced by cardiac and body

position

4. Respiratory pattern

o Recognize the clinical signs of pulmonary congestion

o Know the clinical significance of abnormal respiratory patterns (eg,

tachypnea, hyperpnea, stridor, grunting, retractions, wheezing)

• 5. Cyanosis and other skin manifestations of cardiac disease

• Know the cardiac and noncardiac causes of central cyanosis

• Understand the physiologic significance of central versus peripheral

cyanosis

• Know the significance of jaundice in a cardiac patient

• Know the dermatologic abnormalities in a patient with cardiac disease and

their pathogenesis

• Know the clinical manifestations and significance of embolic phenomena

in patients with cardiac disease

• Recognize and understand the importance of variations in hepatic situs

**B. Surface electrocardiography**

Age-dependent features

• Know age-related changes in ECG wave forms and intervals Hypertrophy

• Recognize the ECG pattern of ventricular hypertrophy at various ages

• Recognize atrial enlargement on ECG

Depolarization

• Recognize variations from normal pattern of atrial depolarization on

ECG and make an interpretation

• Recognize variations from normal pattern of ventricular

depolarization on ECG and make an interpretation

• Differentiate the ECG patterns associated with preexcitation,

bundle branch block, and hemiblock

4. Repolarization

• Recognize on ECG variations from normal pattern of ventricular

repolarization and make an interpretation

5. Clinical applications

• Recognize patterns of ischemia, injury, and infarction

6. Monitoring

• Know the indications for 24-hour ambulatory ECG recording, how to

recognize artifacts, and how to interpret the results

• Know the indications for use of an event monitor or an implantable

loop recorder and how to interpret the results

**C. Exercise stress testing**

• Know the guidelines for exercise in normal children

• Know the guidelines for exercise in children with cardiovascular disease

• Recognize the normal responses to exercise in terms of heart rate, blood

pressure, cardiac output, oxygen uptake and consumption, and venous

return

• Understand the ventilatory response to CO2 in terms of CO2 response

curves and central and peripheral chemoreceptors

• Know the indications for and risks of exercise testing in children

• Understand the techniques, physiology, advantages, and disadvantages

of the different types of exercise (cycle, treadmill, hand-grip exercise)

• Understand the physiologic principles related to electrocardiographic

responses to exercise

• Understand the physiologic principles involved in the ventilatory response

to exercise

• Understand the indications of nuclear medicine stress testing

**D. Echocardiography/Doppler methods (includes fetal)**

• . Assess systolic and diastolic function utilizing echocardiography

• Know how to determine gradients and pressure measurement from

Doppler-derived velocity measurements

• Know how Doppler-derived velocity measurements compare to directpressure

gradient determinations

• Understand the principles of echocardiography

• Understand the physics of echocardiography

• Know the indications for, risks of, and limitations of transesophageal,

stress, and fetal echocardiography

• Recognize normal cardiac anatomy on echocardiography

**E. Catheterization and intervention**

1. General principles

• Know the indications and contraindications for and risks of cardiac

catheterization

• Know the most appropriate positional view to obtain optimal

angiographic visualization of the targeted cardiac and vasculature

structure of interest

• Interpret normal and abnormal pressure data during cardiac

catheterization

• Know the normal and potential abnormal courses of a cardiac

catheter during cardiac catheterization and angiography

2. Calculating cardiac output and shunts

Invasive and noninvasive methods of calculating cardiac output

• Know how to calculate myocardial oxygen consumption from data

measuring coronary blood flow and oxygen saturation

• Understand the concept, use, and limitations of the Fick method to

determine blood flow (systemic and pulmonary)

• Calculate a right-to-left and a left-to-right shunt given relevant oxygen data

• Know how to arrive at a physiologic diagnosis given saturation data

• Understand the concept of effective pulmonary blood flow

• Recognize important sources of measurement error when quantifying

ventricular function by invasive methods

3. Interventional catheterization: balloon angioplasty/valvuloplasty/stent

placement and angiography

• Know which lesions can be dilated by angioplasty

• Understand the factors associated with angioplasty (eg, indications,

contraindications, risks, and limitations)

• Know how to perform angioplasty of native and postoperative

pulmonary branch stenosis

• Manage the complications of angioplasty

• Interpret patterns of pulmonary and systemic vasculature on

angiography

• Understand the factors associated with use of angiography (eg,

risks, risk management, complications, and contraindications)

• Know the methods for and limitations of calculations of pulmonary

and systemic vascular resistance and its application

• Know which valve lesions are candidates for balloon valvuloplasty

• Understand the factors associated with stent placement (eg,

indications, contraindications, risks, and limitations)

• Understand the basic technical aspects of stent placement

• Understand medical management implications following stent

placement in lesions

• Identify and manage the complications of stent placement

• Understand the factors associated with dilation of bioprosthetic

valves/conduits (eg, indications, contraindications, risks, and

limitations)

• Understand the factors associated with bioprosthetic

valves/conduits (eg, indications, contraindications, risks, and

limitations)

• Know how to perform angioplasty of bioprosthetic valves/conduits

4. Transeptal puncture and atrioseptostomy

• Know the indications, contraindications, risks, and limitations of

atrioseptostomy

• Understand the basic technical aspects of balloon atrial septostomy

• Understand the factors associated with transeptal puncture (eg,

indications, contraindications, risks, and limitations)

5. Occlusion techniques

• Understand the factors associated with occlusion techniques (eg,

indications, contraindications, risks, and limitations)

• Understand the basic technical aspects of occlusion techniques

• Recognize commonly approved occlusion devices for cardiac defects

• Plan appropriate management and follow-up evaluation relative to

complications of occlusion devices

• Plan prophylactic management of thrombosis following the use of an

occlusion device

• Percutaneous valve placement a. Understand the principles of

percutaneous valve placement

• Other interventional procedures a. Understand the basic principles and

techniques of latest interventional technologies

6. Cardiac magnetic resonance imaging (MRI) and angiography (MRA) and

computed tomography (CT) scan

• Understand the factors associated with cardiac CT scan and CT

angiography (eg, indications, contraindications, and risks)

• Understand the factors associated with use of cardiac MRI (eg,

indications, contraindications, risks, and limitations)

• Diagnose cardiovascular disease based on cardiac computed tomography

• Diagnose cardiac disease based on findings on cardiac MRI

• Know the factors associated with MRI/MRA assessment of cardiovascular

function, including flow (eg, indications, techniques, limitations)

7. Nuclear testing

• Know the indications, contraindications, risks, and limitations of

radionuclide angiocardiography

• Recognize the clinical implications of normal and abnormal findings on

lung perfusion scans and ventilation/perfusion scans

H. Other forms of cardiac testing

• Pulse oximetry a. Interpret the principles of pulse oximetry in the

evaluation of a patient with cardiovascular disease

• X-ray studies of the chest

• Electrophysiologic testing

I. Electrocardiographic diagnosis

• Recognize electrocardiographic features of first-, second-, and thirddegree

atrioventricular block

• Recognize electrocardiographic features of atrial and ventricular ectopy

J. Laboratory testing

1. Erythrocyte indices

• Recognize alterations in erythrocyte indices that are important in

the evaluation of a patient with cardiovascular disease

2. Arterial blood gases and pH

• Understand factors which influence oxygen-hemoglobin linkage

and dissociation curves

• Understand how arterial blood gases and pH are used in the

assessment of cardiovascular disease

3. Cardiac injury profiles

• Know the uses of serum creatine kinase activity and troponin I and T

concentration measurements in a patient with cardiovascular disease

• Heart failure profiles a. Understand the use and limitations of biomarkers

in the evaluation of acute and chronic heart failure.

**Office-Based Cardiac Problems**

**A. Syncope**

• Know how to evaluate syncope and presyncope

• Diagnose and manage neurocardiogenic syncope

• Know the differential diagnosis of syncope

**B. Lipidopathies and coronary risk management**

• Know the various types of hyperlipidemias, including manifestations, their

genetic basis, mode of transmission, diagnosis, and management

• Interpret serum lipid profile tests in children

• Plan appropriate management of a child with hypercholesterolemia

• Know the recommended daily dietary saturated fat intake for children of

different ages

• Know the risk factors for hyperlipidemia and the timing of lipid testing

based on risk factors

**C. Hypertension**

• Recognize and plan an appropriate evaluation in a patient with systemic

hypertension

• Plan appropriate management of systemic hypertension

• Understand the natural history of systemic hypertension in children

**D. Exercise restrictions in congenital heart disease**

• Know the guidelines for exercise in normal children

• Know the guidelines for exercise in children with cardiovascular disease

**E. Chest pain**

• Plan the diagnosis and management of chest pain in children and

adolescents

**F. Cardiovascular problems in the athlete**

• Know how to use echocardiography to recognize physiologic cardiac

hypertrophy in an athlete, including differentiation from pathologic

hypertrophy

• Understand and recognize cardiovascular and electrocardiographic

changes (eg, heart rate, blood pressure, LV mass) in a well-trained athlete

• Identify the cause(s) of sudden cardiac death in an athlete

• Understand utilization and limitations of cardiovascular screening of the

athlete and school-aged child

**G. Cyanosis**

• Recognize manifestations of acute and chronic insufficient pulmonary

blood flow

**H. Palpitations**

• Plan the evaluation and management of palpitations in children and

adolescents

**I. Murmurs**

**Left-to-Right Shunts**

Atrial septal defects (non-AVSD types)

1. Anatomy

• Recognize the anatomic characteristics of different types of atrial septal

defects

• Recognize cardiovascular lesions commonly associated with an atrial

septal defect

2. Physiology a. Understand the factors that affect shunting at the atrial level

3. Natural history

• Understand the short- and long-term effects of an atrial septal

defect on pulmonary vascular bed and cardiac function

• Understand the relationship between an atrial septal defect and

arrhythmia

• Understand the relationship between an atrial septal defect and

strokes

4. Clinical findings

• Recognize the clinical findings consistent with an atrial septal

defect

5. Laboratory findings

• Recognize features associated with atrial septal defect using

available laboratory tests and recognize important anatomic

features that could affect surgical management

• Calculate pulmonary and systemic flows, blood flow ratios, and

resistance by various modalities in a patient with atrial septal defect

• Recognize the cardiac MRI features associated with each type of

atrial septal defect

6. Management, including complications

• Develop an appropriate management plan for a patient with an

atrial septal defect

• Determine the appropriate timing of surgical or catheter intervention

in a patient with an atrial septal defect

• Identify and manage the early and long-term complications of

surgical or catheter closure of an atrial septal defect

Atrioventricular septal defects

1. Embryology, epidemiology, and genetics

• Recognize the genetic syndromes associated with atrioventricular

septal defect

2. Anatomy

• Recognize cardiovascular lesions commonly associated with

atrioventricular septal defect including varying AVV morphology and

insertion

3. Physiology

• Identify the effects of an atrioventricular septal defect on the

pulmonary vascular bed

• Understand the factors that determine shunting at atrial and

ventricular levels in atrioventricular septal defect

4. Natural history a. Understand the natural history of atrioventricular septal

defect

5. Clinical findings a. Recognize the clinical findings consistent with an

atrioventricular septal defect

6. Laboratory findings

• Recognize features of atrioventricular septal defects using available

laboratory tests and recognize important anatomic features that

could affect surgical management

• Evaluate pulmonary pressures in a patient with atrioventricular

septal defect

• Recognize the various atrioventricular valve morphologies and

attachments in a patient with atrioventricular septal defect

7. Management, including complications

o Recognize implications of straddling and overriding of

atrioventricular valves on management decisions

o Plan appropriate medical management of a patient with an

atrioventricular septal defect

o Plan the appropriate timing of surgery in a patient with an

atrioventricular septal defect

o Recognize and manage early and long-term complications of

surgical repair of an atrioventricular septal defect

o Recognize and manage the complications of an unoperated

atrioventricular septal defect

Non-AVSD Ventricular septal defects

1. Embryology, epidemiology, and genetics

• Recognize specific genetic syndromes associated with ventricular

septal defect

2. Anatomy

• Know the anatomic location of various types of ventricular septal

defects

• Recognize cardiovascular lesions commonly associated with

ventricular septal defect

3. Physiology

• Identify the effects of a ventricular septal defect on the pulmonary

vascular bed

• Understand the effects of ventricular septal defect on cardiac

function

• Understand the vascular and cardiac factors that determine

shunting in a ventricular septal defect

4. Natural history a. Understand the natural history of ventricular septal defect

5. Clinical findings

• Differentiate between a closing VSD and development of

subpulmonary obstruction

• Recognize and treat pulmonary arterial hypertension

• Recognize the clinical findings associated with a ventricular septal

defect

• Recognize the clinical findings of commonly associated

cardiovascular lesions with a ventricular septal defect (eg, aortic

insufficiency, patent ductus arteriosus, double-chambered right

ventricle)

6. Laboratory findings

• Recognize the anatomic types of features of ventricular septal

defect using available laboratory tests and recognize important

anatomic features that could affect surgical management

• Distinguish between restrictive and nonrestrictive communications

by Doppler echocardiography in a patient with a ventricular septal

defect

7. Management, including complications

• Recognize and manage the early and long-term complications

following surgical repair or catheter device closure of a ventricular

septal defect

• Plan management of a patient with VSD and aortic regurgitation

• Plan appropriate medical management of a patient with ventricular

septal defect

• Plan the appropriate timing of surgical or catheter intervention in

the management of a patient with ventricular septal defect

• Recognize and manage the complications of unoperated ventricular

septal defect

D. Patent ductus arteriosus

1. Embryology, epidemiology, and genetics

• Know the embryologic basis of patent ductus arteriosus

2. Anatomy

• Recognize the anatomic details of patent ductus arteriosus

• Recognize lesions commonly associated with patent ductus

arteriosus

3. Physiology

• Identify the effects of patent ductus arteriosus on the pulmonary

vascular bed

• Recognize the effects of gestational age at birth and postnatal age

on the presentation of a patent ductus arteriosus

• Understand the effects of a patent ductus arteriosus on cardiac

function

• Understand the determinants of shunting in patent ductus

arteriosus

4. Natural history a. Understand the natural history of patent ductus arteriosus

5. Clinical findings

• Recognize the clinical findings associated with patent ductus

arteriosus

6. Laboratory findings

• Recognize features of patent ductus arteriosus of various sizes

using available laboratory tests and recognize important anatomic

features that could affect surgical management

• Assess volume overload and estimate pulmonary arterial pressures

by echocardiography in a patient with patent ductus arteriosus

7. Management, including complications

• Plan management of patent ductus arteriosus in preterm and term

infants, including appropriate use of prostaglandin inhibitors

• Plan the timing of surgical or catheter intervention in a patient with

patent ductus arteriosus

• Recognize possible early and long-term complications of surgical or

transcatheter repair of patent ductus arteriosus

• Recognize and manage the complications of untreated patent

ductus arteriosus

• Understand the relationship between patent ductus arteriosus and

necrotizing enterocolitis in preterm and full-term infants

Coronary arteriovenous fistula

1. Anatomy

• Understand the pathologic features of a coronary arteriovenous

fistula

2. Physiology

• Understand the vascular physiology of a large coronary

arteriovenous fistula

3. Natural history a. Understand the natural history of coronary arteriovenous

fistula

4. Clinical findings a. Recognize the clinical findings of coronary arteriovenous

fistula

5. Laboratory findings a. Recognize features associated with coronary

arteriovenous fistula using available laboratory tests and recognize important

anatomic features that could affect surgical management

6. Management, including complications

• Plan the appropriate technique and timing of surgical or catheter

intervention in a patient with coronary arteriovenous fistula

• Identify and manage possible complications of surgical or

transcatheter repair of coronary arteriovenous fistula

• Recognize and manage the complications of an untreated

arteriovenous fistula

Aortopulmonary window

1. Embryology, epidemiology, and genetics

• Know the embryologic basis of aortopulmonary window

2. Anatomy

• Recognize the anatomic details of an aortopulmonary window

• Recognize lesions commonly associated with an aortopulmonary

window

3. Physiology

• Identify the effects of an aortopulmonary window on the pulmonary

vascular bed

4. Natural history

• Understand the natural history of an unoperated

aortopulmonary window

5. Clinical findings

• Recognize the clinical presentation of aortopulmonary

window

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6. Laboratory findings

• Recognize features consistent with a diagnosis of

aortopulmonary window by available laboratory tests and

recognize important features that could affect surgical

management

7. Management, including complications

• Plan the appropriate timing of surgical or catheter

intervention in a patient with aortopulmonary window

• Recognize and manage the long-term complications of

unoperated aortopulmonary window.

**Right-to-Left Shunts**

A. Tetralogy of Fallot

1. Embryology, epidemiology, and genetics

• Know the embryology, epidemiology, and genetics for tetralogy of

Fallot

• Recognize genetic syndromes associated with tetralogy of Fallot

2. Anatomy

• Recognize the commonly associated lesions in a patient with

tetralogy of Fallot

• Recognize the anatomic features in a patient with tetralogy of Fallot

3. Physiology

• Understand the circulatory abnormalities in a patient with tetralogy

of Fallot, including the pathophysiology of a hypercyanotic episode

4. Natural history a. Know the natural history of tetralogy of Fallot

5. Clinical findings

• Recognize the clinical features of hypercyanotic episodes in

patients with tetralogy of Fallot

6. Laboratory findings

• Appropriately use and interpret diagnostic studies for evaluation

and treatment planning in tetralogy of Fallot

• Recognize hemodynamic and angiographic findings of tetralogy of

Fallot

7. Management, including complications

• Plan management of a hypercyanotic episode in a patient with

tetralogy of Fallot

• Plan the treatment approach for palliation or correction of tetralogy

of Fallot

• Recognize the complications of cyanosis in untreated tetralogy of

Fallot

• Recognize and manage complications after treatment of tetralogy

of Fallot

**Double-outlet right ventricle**

1. Embryology, epidemiology, and genetics

• Understand the etiology, epidemiology, and genetic syndromes

associated with double-outlet right ventricle

2. Anatomy

• Recognize the anatomic features of double-outlet right ventricle and

commonly associated lesions

3. Physiology

• Understand the circulatory physiology of double-outlet right

ventricle and its relationship with anatomic features

4. Laboratory findings

• Appropriately use and interpret diagnostic studies for evaluation

and treatment planning in double-outlet right ventricle

5. Management, including complications

• Recognize the effects of the transitional circulation on the clinical

presentation of double-outlet right ventricle

• Plan the treatment of double-outlet right ventricle based on

anatomic and physiological variables

• Recognize and manage the early and long-term complications after

therapy in a patient with double-outlet right ventricle

**Pulmonary atresia with intact septum**

1. Embryology, epidemiology, and genetics

• Know the embryology, epidemiology, and genetics of pulmonary

atresia with intact septum

• Recognize the etiology, epidemiology, and genetic syndromes

associated with pulmonary atresia with intact septum

2. Anatomy

• Recognize the anatomic features and their prognostic significance

in pulmonary atresia with intact septum

• Recognize cardiovascular lesions commonly associated with

pulmonary atresia with intact septum

3. Physiology

• Understand the physiologic consequences of the anatomic

spectrum of pulmonary atresia with intact septum

4. Natural history

• Understand the range of natural history in pulmonary atresia with

intact septum

5. Laboratory findings

• Appropriately use and interpret diagnostic studies for evaluation

and treatment planning in pulmonary atresia with intact ventricular

septum before and after intervention.

6. Management, including complications

• .Plan the treatment of pulmonary atresia with intact septum

• b. Recognize and manage early and long-term complications of

therapy in pulmonary atresia with intact septum

**Pulmonary atresia with ventricular septal defect**

1. Embryology, epidemiology, and genetics

• Know the embryology, epidemiology, and genetics of pulmonary

atresia with ventricular septal defect

• Recognize the etiology, epidemiology, and genetic syndromes

associated with pulmonary atresia with ventricular septal defect

2. Anatomy

• Recognize the abnormalities of the pulmonary vascular bed in

pulmonary atresia with ventricular septal defect

• Recognize lesions commonly associated with pulmonary atresia

with ventricular septal defect

3. Physiology

• Understand the consequences of anatomic variants of pulmonary

atresia with ventricular septal defect on treatment and prognosis

4. Natural history a. Understand the range of natural history in pulmonary atresia

with ventricular septal defect

5. Laboratory findings a. Recognize features associated with pulmonary atresia

with ventricular septal defect using available laboratory tests and recognize

important anatomic features that could affect surgical management

6. Management, including complications

• Plan the treatment of pulmonary atresia with ventricular septal

defect

• Recognize and manage early and long-term complications of

therapy in pulmonary atresia with ventricular septal defect

• Recognize and manage a patient with unoperated pulmonary

atresia and ventricular septal defect

Absent pulmonary valve syndrome

1. Embryology, epidemiology, and genetics

• Recognize the etiology, epidemiology, and genetic syndromes

associated with absent pulmonary valve syndrome

2. Anatomy

• Recognize the anatomic features and associated lesions in a

patient with absent pulmonary valve syndrome

3. Physiology

• Understand the physiologic abnormalities in absent pulmonary

valve syndrome

4. Natural history

• Understand the natural history of absent pulmonary valve

syndrome

5. Clinical findings

• Recognize the clinical features of absent pulmonary valve

syndrome

6. Laboratory findings

• Appropriately use and interpret diagnostic studies for evaluation

and treatment planning in pulmonary atresia with absent

pulmonary valve syndrome before and after intervention.

7. Management, including complications

• Plan the surgical approach for palliation or correction of absent

pulmonary valve syndrome

• Recognize and manage the short- and long-term airway

complications associated with absent pulmonary valve syndrome

**Single Ventricular Lesions**

A. Hypoplastic left heart syndrome

1. Embryology, epidemiology, and genetics a. Recognize the etiology,

epidemiology, and genetic syndromes associated with hypoplastic left heart

syndrome

2. Anatomy

• Identify anatomic features of hypoplastic left heart syndrome

3. Physiology

• Understand the physiology of hypoplastic left heart syndrome

• Understand the circulatory and metabolic effects of hypoplastic left

heart syndrome

• Understand the impact of hypoplastic left heart syndrome and its

variants on fetal pulmonary and neurodevelopment.

4. Clinical findings

• Recognize the range of clinical presentation of hypoplastic left

heart syndrome and its evolution after birth

• Recognize features of hypoplastic left heart syndrome using

available laboratory tests and recognize important anatomic

features that could affect surgical management

5. Management, including complications

• Plan appropriate management of obstructed atrial septum in a

patient with hypoplastic left heart syndrome

• Recognize the treatment options for hypoplastic left heart

syndrome, their merits and drawbacks.

• Plan the management of a neonate with hypoplastic left heart

syndrome who has undergone Norwood palliation

• Plan the management of an infant with hypoplastic left heart

syndrome who has undergone hybrid palliation

B. Tricuspid atresia

1. Etiology, epidemiology, and genetics

• Understand the embryologic basis of tricuspid atresia

2. Anatomy

• Identify anatomic features of tricuspid atresia and associated

lesions

3. Physiology

• Understand the circulatory physiology of tricuspid atresia

4. Natural history

• Understand the natural history of tricuspid atresia

5. Clinical findings

• Recognize the clinical findings in a patient with tricuspid atresia

6. Laboratory findings

• Recognize features of tricuspid atresia using available laboratory

tests and recognize important anatomic features that could affect

surgical management

7. Management, including complications

• Plan appropriate medical management for a patient with tricuspid

atresia

• Diagnose and manage the postoperative complications following

surgical palliation of tricuspid atresia

Other forms of single (univentricular) heart

1. Etiology, epidemiology, and genetics

• Understand the developmental basis for a univentricular heart

2. Anatomy

• Identify anatomic features of the various forms of univentricular

heart

3. Physiology

• Understand the physiology of the univentricular heart

4. Natural history

• Understand the natural history of univentricular hearts and the

impact on surgical decisions

5. Clinical findings a. Recognize the typical clinical findings of univentricular

hearts

6. Laboratory findings a. Recognize features associated with univentricular heart

using available laboratory tests and recognize important anatomic features that

could affect surgical management

7. Management, including complications

• Plan medical management of a patient with univentricular heart

• Plan surgical management of a patient with a univentricular heart

• Manage complications of the natural history and medical therapy of

a univentricular heart

• Manage complications of neonatal surgical palliations in

univentricular hearts after treatment

**The Glenn and Fontan Circulation**

1. Etiology, epidemiology, and genetics a. Recognize the indications and

contraindications to Glenn and Fontan operations

2. Anatomy a. Identify anatomical variants of Glenn and Fontan circulation

3. Physiology a. Know the physiologic effects of Glenn and Fontan circulation on

the heart and circulation

4. Clinical findings a. Recognize the typical clinical features of a Glenn and

Fontan circulation

5. Laboratory findings a. Recognize features associated with Glenn and Fontan

circulation using available laboratory tests and recognize important anatomic

features that could affect management

6. Management, including complications

• Recognize and manage the early and long-term complications of a

patient with Glenn and Fontan circulation, such as protein-losing

enteropathy

**Structural, Valvar, and Obstructive Lesions**

A. Tricuspid valve

**a.** Tricuspid stenosis and regurgitation

**b.** . Ebstein anomaly of the tricuspid valve

**c.** Obstructive lesions of the right ventricular outflow tract,

pulmonary valve, and pulmonary branches

**d.** Pulmonary valve stenosis

**e.** Pulmonary regurgitation

**f.** Pulmonary branch stenosis

**g.** Mitral stenosis, mitral regurgitation, and mitral valve

prolapse

**h.** Obstructive lesions of the left ventricular outflow tract, aortic

valve, and aortic

**i.** Bicuspid aortic valve a. Anatomy

**j.** Aortic valve stenosis and regurgitation

**k.** Supravalvar aortic stenosis

• Etiology, epidemiology, and genetics

• Anatomy

• Physiology

• Natural history

• Clinical findings

• Laboratory findings

• Management, including complications

**Congenital Abnormalities of the Great Arteries and Aorta**

A. Truncus arteriosus

B. Transposition of the great arteries

C. Congenitally corrected transposition of the great arteries

• Etiology, epidemiology, and genetics

• Anatomy

• Physiology

• Natural history

• Clinical findings

• Laboratory findings

• Management, including complications

**Aortic root and arch abnormalities**

1. Management, including complications a. Recognize and manage root and

arch abnormalities associated with connective tissue abnormalities

2. Vascular rings and slings

• Etiology, epidemiology, and genetics

• Anatomy

• Physiology

• Natural history

• Clinical findings

• Laboratory findings

• Management, including complications

**Congenital malformations of the coronary circulation**

Anomalous left coronary artery from the pulmonary artery

• Etiology, epidemiology, and genetics

• Anatomy

• Physiology

• Natural history

• Clinical findings

• Laboratory findings

• Management, including complications

**Systemic and Pulmonary Venous Abnormalities and Situs Abnormalities**

A. Systemic venous abnormalities

B. Abnormalities of the pulmonary venous system

C. Cor triatriatum

D. Pulmonary venous stenosis/atresia

E. Situs abnormalities and heterotaxy syndromes

F. Ectopia cordis

• Etiology, epidemiology, and genetics

• Anatomy

• Physiology

• Natural history

• Clinical findings

• Laboratory findings

• Management, including complications

**Disorders of the Myocardium, Pericardium, Endocardium, and Vasculature**

A. Cardiomyopathies (including systolic dysfunction, diastolic dysfunction, and

hypertrophic)

B. Cardiomyopathy in muscular dystrophies

C. Cardiomyopathies in metabolic diseases (includes storage diseases)

D. Transplant medicine

E. Pericardial diseases

F. Cardiac tumors

G. Pulmonary hypertension

• Etiology, epidemiology, and genetics

• Anatomy

• Physiology

• Natural history

• Clinical findings

• Laboratory findings

• Management, including complications

**Heart Function and Disease in the Fetus and Newborn**

A. Fetal diagnosis and management of congenital heart disease

B. Fetal arrhythmias

C. Effects of systemic disease on the fetal heart

D. Effects of maternal disease on the fetal heart

E. Transitional physiology and pulmonary hypertension of the newborn

F. Initial stabilization and management of the newborn with congenital heart

disease

**Intensive Care Management of Patients with Congenital Heart Disease** A.

Airway support, mechanical ventilation, and effects on congenital heart disease

B. Low cardiac output state

C. Cardiopulmonary resuscitation

D. Acute management of pulmonary hypertension

E. Multiorgan system management

F. Quality improvement

G. Perioperative issues

**Arrhythmias**

A. General principles

1. Classification

• Formulate a differential diagnosis of rhythm disturbances causing a

narrow QRS tachycardia, a wide QRS tachycardia, and bradycardia

2. Symptoms

• Identify the signs and symptoms associated with rhythm

abnormalities

• Evaluate a patient who has experienced a cardiac arrest

• Evaluate a family with a history of sudden cardiac death

3. Basis or cause/physiology

• Understand the physiologic consequences of rhythm disturbances

• Understand the mechanisms involved in the genesis of cardiac

arrhythmias (eg, re-entry, automaticity, conduction block)

4. Therapy

A. General principles

• Understand the indications for acute and chronic medical

management of tachy- and bradyarrhythmias

• Know the mechanical methods (eg, vagal maneuvers; esophageal,

external, intracardiac pacing; cardioversion) available for treatment

of arrhythmias

• Identify the clinical features and genetic causes of diseases

associated with arrhythmias (eg, LQTS, ARVD, Brugada syndrome,

CPVT, cardiomyopathies, preexcitation)

B. Autonomic interventions

• Know the techniques for use of vagal maneuvers (including

indications, contraindications, risks, and limitations) (eg, Valsalva,

ice to face, carotid sinus massage)

• Know the effect of vagal maneuvers in treating cardiac arrhythmias

C. Temporary pacing

• Understand the factors associated with temporary pacing (eg,

indications, contraindications, risks, and limitations)

• Understand the basic technical aspects of the different modalities

available for temporary pacing

D. Cardioversion/defibrillation

• Understand the factors associated with cardioversion/defibrillation

(eg, indications, contraindications, risks, and limitations)

• Understand the basic technical aspects of

cardioversion/defibrillation

E. Implantable devices

• Recognize pacing mode and pacemaker malfunction by ECG

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• Understand the factors associated with permanent pacing (eg,

indications, contraindications, risks, and limitations)

• Understand the factors associated with an implantable cardioverterdefibrillator

(eg, indications, contraindications, risks, and limitations

• Understand the basic technical aspects for insertion of a permanent

pacemaker or an implantable cardioverter-defibrillator

• Understand the factors associated with bi-ventricular

resynchronization pacing (eg, indications, contraindications, risks,

and limitations)

Ectopy

1. Clinical recognition a. Recognize clinical manifestations and significance of

ectopy

2. Basis or cause

• Recognize the association of ectopic atrial tachycardias with

surgery for congenital heart disease

3. Management

• Plan the evaluation and management of a patient with

frequent atrial or ventricular ectopy

Supraventricular arrhythmias

**1. Sinus tachycardia**

a. Clinical recognition

• Recognize the clinical features of sinus tachycardia

• Differentiate sinus tachycardia by surface electrocardiographic

criteria

• Recognize intracardiac electrophysiologic characteristics of sinus

tachycardia

b. Basis or cause

• Understand the mechanisms and natural history of sinus

tachycardia

• Recognize the association of sinus tachycardia with surgery for

congenital heart disease (acute and long-term)

• c. Management

• Recognize and medically manage sinus tachycardia in patients of

varying ages (eg, fetus, infant, child, adolescent, young adult)

• Recognize and manage the consequences of long-term sinus

tachycardia

**2. Ectopic atrial tachycardia**

a. Clinical recognition

• Recognize the clinical features of ectopic atrial tachycardia

• Differentiate ectopic atrial tachycardia by surface

electrocardiographic criteria

• Recognize intracardiac electrophysiologic characteristics of ectopic

atrial tachycardia

b. Basis or cause

• Understand the mechanisms and natural history of ectopic atrial

tachycardia

• Recognize the association of certain ectopic atrial tachycardias with

surgery for congenital heart disease (acute and long-term)

c. Management

• Recognize and medically manage ectopic atrial tachycardia in

patients of varying ages (eg, fetus, infant, child, adolescent, young

adult)

• Understand the factors associated with electrophysiologic study

(eg, indications, contraindications, risks, and limitations) and

catheter- or surgical-based ablation therapy for ectopic atrial

tachycardia

• Recognize and manage the consequences of ectopic atrial

tachycardia

**3. Multifocal atrial tachycardia**

**a. Clinical recognition**

• Recognize the clinical features of multifocal atrial tachycardia

• Differentiate multifocal atrial tachycardia by surface

electrocardiographic criteria

• Recognize intracardiac electrophysiologic characteristics of

multifocal atrial tachycardia

**b. Basis or cause**

• Understand the mechanisms and natural history of multifocal atrial

tachycardia

**c. Management**

• Recognize and medically manage multifocal atrial tachycardia in

patients of varying ages (eg, fetus, infant, child, adolescent, young

adult)

• Understand the factors associated with electrophysiologic study

(eg, indications, contraindications, risks, and limitations) and

catheter- or surgical-based ablation therapy for multifocal atrial

tachycardia

• Recognize and manage the consequences of multifocal atrial

tachycardia

**4. Atrial flutter (intra-atrial reentry)**

a. Clinical recognition

• Recognize the clinical features of atrial flutter

• Differentiate atrial flutter by surface electrocardiographic criteria

• Recognize intracardiac electrophysiologic characteristics of atrial

flutter

b. Basis or cause

• Understand the mechanisms and natural history of atrial flutter

• Recognize the association of atrial flutter with surgery for congenital

heart disease (acute and long-term)

c. Management

• Recognize and medically manage atrial flutter in patients of varying

ages (eg, fetus, infant, child, adolescent, young adult)

• Understand the factors associated with electrophysiologic study

(eg, indications, contraindications, risks, and limitations) and

catheter- or surgical-based ablation therapy for atrial flutter

• Recognize and manage the consequences of atrial flutter

**5. Atrial fibrillation**

a. Clinical recognition

• Recognize the clinical features of atrial fibrillation

• Differentiate atrial fibrillation by surface electrocardiographic criteria

• Recognize intracardiac electrophysiologic characteristics of atrial

fibrillation

b. Basis or cause

• Understand the mechanisms and natural history of atrial fibrillation

• Recognize the association of atrial fibrillation with surgery for

congenital heart disease (acute and long-term)

c. Management

• Recognize and medically manage atrial fibrillation in patients of

varying ages (eg, fetus, infant, child, adolescent, young adult)

• Understand the factors associated with electrophysiologic study

(eg, indications, contraindications, risks, and limitations) and

catheter- or surgical-based ablation therapy for atrial fibrillation

• Recognize and manage the consequences of atrial fibrillation

**6. Atrioventricular node reentry**

a. Clinical recognition

• Recognize the clinical features of AV node reentry

• Differentiate AV node reentry by surface electrocardiographic

criteria

• Recognize intracardiac electrophysiologic characteristics of AV

node reentry

b. Basis or cause

• Understand the mechanisms and natural history of AV node

reentry

c. Management

• Recognize and medically manage AV node reentry in patients of

varying ages (eg, fetus, infant, child, adolescent, young adult)

• Understand the factors associated with electrophysiologic study

(eg, indications, contraindications, risks, and limitations) and

catheter- or surgical-based ablation therapy for AV node reentry

• Recognize and manage the consequences of AV node reentry

**7. Junctional ectopic tachycardia**

a. Clinical recognition

• Recognize the clinical features of junctional ectopic tachycardia

• Differentiate junctional ectopic tachycardia by surface

electrocardiographic criteria

• Recognize intracardiac electrophysiologic characteristics of

junctional ectopic tachycardia

b. Basis or cause

• Understand the mechanisms and natural history of junctional

ectopic tachycardia

• Recognize the association of junctional ectopic tachycardia with

surgery for congenital heart disease (acute and long-term)

c. Management

• Recognize and medically manage junctional ectopic tachycardia in

patients of varying ages (eg, fetus, infant, child, adolescent, young adult)

• Understand the factors associated with electrophysiologic study (eg,

indications, contraindications, risks, and limitations) and catheter- or

surgical-based ablation therapy for the congenital type of junctional

ectopic tachycardia

• Recognize and manage the consequences of junctional ectopic

tachycardias

**8. Orthodromic reentry via accessory pathway**

a. Clinical recognition

• Recognize the clinical features of orthodromic reentry via accessory

pathway

• Differentiate orthodromic reentry via accessory pathway by surface

electrocardiographic criteria

• Recognize intracardiac electrophysiologic characteristics of

orthodromic reentry via accessory pathway

b. Basis or cause

• Understand the mechanisms and natural history of orthodromic

reentry via accessory pathway

c. Management

• Recognize and medically manage orthodromic reentry via

accessory pathway in patients of varying ages (eg, fetus, infant,

child, adolescent, young adult)

• Understand the factors associated with electrophysiologic study

(eg, indications, contraindications, risks, and limitations) and

catheter- or surgical-based ablation therapy for orthodromic reentry

via accessory pathway

• Recognize and manage the consequences of orthodromic reentry

via accessory pathway

**9. Permanent form of junctional reciprocating tachycardia**

a. Clinical recognition

• Recognize the clinical features of the permanent form of junctional

reciprocating tachycardia

• Differentiate the permanent form of junctional reciprocating

tachycardia by surface electrocardiographic criteria

• Recognize intracardiac electrophysiologic characteristics of the

permanent form of junctional reciprocating tachycardia

b. Basis or cause

• Understand the mechanisms and natural history of the permanent

form of junctional reciprocating tachycardia

c. Management

• Recognize and medically manage the permanent form of junctional

reciprocating tachycardia in patients of varying ages (eg, fetus,

infant, child, adolescent, young adult)

• Understand the factors associated with electrophysiologic study

(eg, indications, contraindications, risks, and limitations) and

catheter- or surgical-based ablation therapy for the permanent

form of junctional reciprocating tachycardia

• Recognize and manage the consequences of the permanent form

of junctional reciprocating tachycardia

**10. Antidromic reentry via accessory pathway**

a. Clinical recognition

• Recognize the clinical features of antidromic reentry via accessory

pathway

• Differentiate antidromic reentry by surface electrocardiographic

criteria

• Recognize intracardiac electrophysiologic characteristics of

antidromic reentry

b. Basis or cause

• Understand the mechanisms and natural history of antidromic

reentry

c. Management

• Recognize and medically manage antidromic reentry in patients of

varying ages (eg, fetus, infant, child, adolescent, young adult)

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• Understand the factors associated with electrophysiologic study

(eg, indications, contraindications, risks, and limitations) and

catheter- or surgical-based ablation therapy for antidromic reentry

• Recognize and manage the consequences of antidromic reentry

**Accessory AV connection and pre-excitation syndrome**

1. Clinical recognition

• Recognize clinical features associated with accessory

atrioventricular connection or pre-excitation syndromes

• Recognize associated cardiac defects in a patient with an

accessory atrioventricular connection

2. Electrocardiographic diagnosis

• Recognize the ECG features of an atrioventricular connection or

pre-excitation syndrome

3. Electrophysiologic diagnosis

• Recognize characteristics of accessory atrioventricular connections

or pre-excitation syndromes based on electrophysiologic studies

4. Basis or cause

• Know the natural history of accessory atrioventricular connections

or pre-excitation syndromes

5. Management

• Plan the management of patients with accessory atrioventricular

connections or pre-excitation syndromes

**Ventricular arrhythmias**

**1. Benign ventricular ectopy**

a. Clinical recognition

• Distinguish the clinical features of benign ventricular ectopy and

distinguish from more serious ventricular arrhythmias

• Know the risk factors, clinical features, and natural history of benign

ventricular ectopy associated with a structurally normal heart or

congenital heart disease

• Know the differential diagnosis of benign ventricular ectopy on

electrocardiogram

• Identify the specific electrocardiographic features of diseases

associated with benign ventricular ectopy

b. Basis or cause

• Understand the mechanisms and natural history of benign

ventricular ectopy

c. Management

• Plan the acute and chronic management of benign ventricular

ectopy

**2. Idiopathic outflow tract ventricular ectopy**

a. Clinical recognition

• Distinguish the clinical features of benign idiopathic outflow tract

ventricular ectopy

• Know the risk factors, clinical features, and natural history of lifethreatening

benign idiopathic outflow tract ventricular ectopy

associated with a structurally normal heart or congenital heart

disease

• Know the differential diagnosis of idiopathic outflow tract ventricular

ectopy on electrocardiogram

b. Basis or cause

• Understand the mechanisms and natural history of idiopathic outflow tract

ventricular ectopy

c. Management

• Plan the acute and chronic management of idiopathic outflow tract

ventricular ectopy and ventricular fibrillation in patients with and without

surgery for congenital heart disease

**3. Verapamil-sensitive LV septal ventricular tachycardia**

a. Clinical recognition

• Distinguish the clinical features of benign verapamil-sensitive LV septal

ventricular tachycardia

• Know the risk factors, clinical features, and natural history of lifethreatening

verapamil-sensitive LV septal ventricular tachycardia

associated with a structurally normal heart or congenital heart disease

• Know the differential diagnosis of verapamil-sensitive LV septal ventricular

tachycardia on electrocardiogram

b. Basis or cause

• Understand the mechanisms and natural history of verapamilsensitive

LV septal ventricular tachycardia

c. Management

• Plan the acute and chronic management of verapamil-sensitive LV

septal ventricular tachycardia in patients with and without surgery

for congenital heart disease

**4. Scar-related macroreentrant ventricular tachycardia**

a. Clinical recognition

• Distinguish the clinical features of scar-related macroreentrant

ventricular tachycardia

• Know the risk factors, clinical features, and natural history of lifethreatening

scar-related macroreentrant ventricular tachycardia

associated with a structurally normal heart or congenital heart

disease

• Know the differential diagnosis of scar-related macroreentrant

ventricular tachycardia on electrocardiogram

• Identify the specific electrocardiographic features of diseases

associated with life-threatening scar-related macroreentrant

ventricular tachycardia

b. Basis or cause

• Understand the mechanisms and natural history of scar-related

macroreentrant ventricular tachycardia

c. Management

• Plan the acute and chronic management of scar-related

macroreentrant ventricular tachycardia and ventricular fibrillation in

patients with and without surgery for congenital heart disease

**5. Ventricular tachycardia in cardiomyopathy**

a. Clinical recognition

• Know the risk factors, clinical features, and natural history of lifethreatening

ventricular tachycardia in cardiomyopathy associated

with a structurally normal heart or congenital heart disease

• Know the differential diagnosis of ventricular tachycardia in

cardiomyopathy on electrocardiogram

• Identify the specific electrocardiographic features of diseases

associated with life-threatening ventricular tachycardia in

cardiomyopathy

b. Basis or cause

• Understand the mechanisms and natural history of ventricular

tachycardia in cardiomyopathy

c. Management

• Plan the acute and chronic management of ventricular tachycardia

in cardiomyopathy in patients with and without surgery for

congenital heart disease

**6. Catecholaminergic polymorphic ventricular tachycardia**

a. Clinical recognition

• Distinguish the clinical features of benign catecholaminergic

polymorphic ventricular tachycardia

• Know the risk factors, clinical features, and natural history of lifethreatening

catecholaminergic polymorphic ventricular tachycardia

associated with a structurally normal heart or congenital heart

disease

• Know the differential diagnosis of catecholaminergic polymorphic

ventricular tachycardia on electrocardiogram

• Identify the specific electrocardiographic features of diseases

associated with life-threatening catecholaminergic polymorphic

ventricular tachycardia

b. Basis or cause

• Understand the mechanisms and natural history of

catecholaminergic polymorphic ventricular tachycardia

c. Management

• Plan the acute and chronic management of catecholaminergic

polymorphic ventricular tachycardia in patients with and without

surgery for congenital heart disease

**7. Arrhythmogenic RV cardiomyopathy**

a. Clinical recognition

• Distinguish the clinical features of arrhythmogenic RV

cardiomyopathy

• Know the risk factors, clinical features, and natural history of lifethreatening

benign arrhythmogenic RV cardiomyopathy associated

with a structurally normal heart or congenital heart disease

• Know the differential diagnosis of benign arrhythmogenic RV

cardiomyopathy on electrocardiogram

• Identify the specific electrocardiographic features of diseases

associated with life-threatening right ventricular cardiomyopathy

b. Management

• Plan the acute and chronic management of arrhythmogenic RV

cardiomyopathy in patients with and without surgery for congenital

heart disease

**8. Torsade de pointe ventricular tachycardia**

a. Clinical recognition

• Distinguish the clinical features of torsade de pointe ventricular

tachycardia

• Know the risk factors, clinical features, and natural history of lifethreatening

torsade de pointe ventricular tachycardia associated

with a structurally normal heart or congenital heart disease

• Know the differential diagnosis of torsade de pointe ventricular

tachycardia on electrocardiogram

• Identify the specific electrocardiographic features of diseases

associated with life-threatening torsade de pointe ventricular

tachycardia

b. Basis or cause

• Understand the mechanisms and natural history of torsade de

pointe ventricular tachycardia

c. Management

• Plan the acute and chronic management of torsade de pointe

ventricular tachycardia in patients with and without surgery for

congenital heart disease

**Long QT syndrome and channel abnormalities**

1. Clinical recognition

• Recognize and plan appropriate management of long QT interval

syndromes and other channel abnormalities (eg, Brugada

syndrome, CPMT, ARVD)

• Recognize the association between long QT interval and torsades

de pointes

2. Basis or cause

• Recognize the genotypic-phenotypic relationships and identify the

genes associated with long QT syndrome and other channel

abnormalities

• Recognize the therapeutic implications for the long QT syndrome

genotype

• Know the mode of transmission, application, and interpretation of

genetic tests of inherited channelopathies

3. Management

• Plan the medical management of arrhythmias of inherited

channelopathies

• Understand the indications for implantation of an intracardiac

device for inherited channelopathies

• Understand the potential role of cardiac sympathectomy in

management of channelopathies

**Atrioventricular block**

1. Clinical recognition

• Know causes of neonatal complete atrioventricular block (maternal SLE,

complex heart disease)

• Recognize clinical manifestations of atrioventricular block

2. Basis or cause

• Know congenital defects associated with atrioventricular block

• Recognize the association of cardiac surgery with atrioventricular

block

• Recognize noncardiac diseases associated with atrioventricular

block (eg, mitochondrial myopathy, myotonic dystrophy)

• Recognize acquired cardiac diseases associated with

atrioventricular block (eg, Lyme disease)

• Know the natural history of atrioventricular block of various causes

(eg, congenital, acquired, surgically induced)

3. Management

• Plan appropriate management of atrioventricular block of various causes

(eg, congenital, acquired, surgically induced)

**Sinus node dysfunction**

1. Clinical recognition

• Recognize specific situations involving long QT syndrome and channel

abnormalities

• Recognize ECG features of sinus node dysfunction

• Recognize the electrophysiologic abnormalities of sinus node dysfunction

• Identify symptoms associated with sinus node dysfunction

2. Basis or cause a. Recognize the causes of sinus node dysfunction

3. Management a. Know the indication for permanent pacer implantation in sinus

node dysfunction

**Acquired Forms of Cardiac Disease**

**A. Endocarditis**

• Know the risk factors and cardiac and noncardiac lesions that have

the highest risk of bacterial endocarditis

• Know the common microorganisms responsible for endocarditis

• Recognize the signs and clinical manifestations of infective

endocarditis and the symptoms of bacterial endocarditis resulting in

left-heart versus right-heart endocarditis

• Recognize the symptoms of bacterial endocarditis resulting in leftheart

versus right-heart endocarditis

• Know the criteria for diagnosing endocarditis

• Identify the extracardiac manifestations and complications of

endocarditis and understand their mechanism(s) of development

• Know the indications for surgical management in a patient with

endocarditis

• Know the indications for and timing of prophylaxis for bacterial

endocarditis

• Know the current status and duration of therapy of antimicrobial

therapy of infective endocarditis

• Know the common reasons why endocarditis may yield negative

results of a culture

• Plan the management of the complications of endocarditis

**B. Myocarditis**

• Know the infectious causes of myocarditis

• Know the role of cardiac catheterization and endomyocardial biopsy

in diagnosis and management of myocarditis

• Plan appropriate treatment of myocarditis

• Plan appropriate treatment of the cardiac manifestations of Lyme

disease

• Formulate the differential diagnosis of an enlarged cardiac

silhouette in a febrile child

• Formulate the differential diagnosis of an enlarged, poorly

contractile left ventricle

• Understand the natural history of myocarditis

• Know gross and histologic features of major cardiovascular

inflammatory disease

• Recognize myocarditis cardiac manifestations of systemic cardiac

disease (eg, rheumatoid arthritis, Kawasaki disease, sepsis)

• Recognize the clinical presentation and laboratory features of

myocarditis

• Recognize the clinical presentation of viral myocarditis

**C. Kawasaki disease**

• Know pathologic features and clinical cardiovascular manifestations

of Kawasaki disease

• Know the sequence and time of appearance of cardiac lesions

associated with Kawasaki disease

• Understand the indications for and the role of diagnostic imaging in

initial diagnosis and management of Kawasaki disease, including

patients with atypical presentation

• Know the sequence and timing of noncardiac findings associated

with Kawasaki disease

• Know current recommendations for drug treatment of acute and

chronic Kawasaki disease and results of long-term sequelae

**D. Rheumatic fever and rheumatic heart disease**

• Epidemiology and disease burden

• Health system challenges

• Understand the etiologic features and specific anatomic features of

rheumatic fever and rheumatic heart disease

• Understand diagnostic testing and classification of rheumatic fever

• Know the sequence of anatomic features and natural history of rheumatic

fever

• Know the gross and microscopic pathology of rheumatic fever

• Know the effect of pathologic anatomy on physiology in a patient with

rheumatic fever

• Recognize the major and minor manifestations of acute rheumatic fever

and their significance (eg, carditis, chorea, arthritis etc)

• Know the natural history of valve involvement in rheumatic heart disease

and the influence of prophylaxis

• Know how to prevent recurrence of rheumatic fever

• Know the currently recommended drug therapy for a patient with acute

rheumatic fever with and without cardiac involvement

• Know the indications for intervention in a patient with rheumatic heart

disease

**E. Inflammatory heart disease caused by systemic disease**

• Recognize the causes and understand treatment of inflammatory heart

disease caused by systemic disease

**F. Other infectious diseases affecting the heart**

• Identify the common cardiac complications of AIDS and know the

management of each

• Recognize the cardiac findings secondary to congenital rubella

• Know infectious causes of cardiovascular problems in a newborn infant

**G. Cardiac trauma**

• Recognize the significance of clinical history and physical examination in

the evaluation of cardiovascular complications of cardiac trauma

• Recognize the causes and treatments of commotio cordis

• Know the role of noninvasive testing and laboratory findings in evaluation

of cardiac trauma

• Plan appropriate management for a patient having cardiovascular trauma

**H. Coronary disease and myocardial ischemia**

• Recognize the risk factors for and the precursors to the development of

risk factors for coronary artery disease

• Know recommendations for prevention of coronary artery disease,

including diagnostic testing and exercise

**I. Artificial valves, conduits, and hematologic issues**

• Recognize major problems associated with artificial valves and plan

appropriate management

• Regulate anticoagulation therapy (warfarin, heparin, low molecular weight

heparin) in a patient with an artificial valve or conduit, including

management plan at the time of an invasive procedure

• Manage antiplatelet / anticoagulation for noncardiac procedures and

conditions

• Understand the effect of damaged endothelium on thrombosis

• Identify clinical and laboratory manifestations of embolic clotting disorders

• Formulate a differential diagnosis in a patient suspected of having an

embolic clotting disorder

• Understand the physiology of embolic clotting disorders

**Genetic Disorders and Syndromes of the Cardiovascular System**

**Epidemiology and screening of congenital heart disease**

• Know the recurrence risk for the common congenital cardiac anomalies

based upon whether the mother or father is affected (parent-of-origin

effect)

• Know the recurrence risk for the common congenital cardiac anomalies if

a sibling is affected

• Understand appropriate use of genetic testing in unaffected children who

have a family history of cardiovascular disease if a first-degree family

member is affected

• Understand the appropriate use of genetic testing in children with

congenital heart disease and extra-cardiac abnormalities such as

intellectual and developmental disability

• Know the major associated cardiac and noncardiac conditions of trisomy

21 and manage their cardiovascular manifestations

• Know the major associated cardiac and noncardiac conditions of trisomy

18 and manage their cardiovascular manifestations

• Know the major associated cardiac and noncardiac conditions of trisomy

13 and manage their cardiovascular manifestations

• Recognize the clinical signs and symptoms of the cardiovascular

manifestations of monosomy X (Turner syndrome) and manage their

cardiovascular manifestations

• Recognize and diagnose Noonan syndrome and manage its cardiac

manifestations

• Recognize and diagnose Holt Oram syndrome and its molecular

pathogenesis

• Recognize and diagnose LEOPARD syndrome and manage its cardiac

manifestations

• Recognize and diagnose Kartagener (dysmotile cilia) syndrome and

manage its cardiac manifestations

• Recognize and diagnose CHARGE association and manage its

cardiovascular manifestations

• Recognize and diagnose Barth syndrome and manage its cardiovascular

manifestations

• Recognize and diagnose VATER association and manage its

cardiovascular manifestations

• Recognize and diagnose Williams syndrome and manage its cardiac

manifestations

• Recognize and diagnose the cardiac manifestations of Rubinstein-Taybi

syndrome and manage its cardiac manifestations

• Recognize and diagnose Alagille syndrome and manage its cardiac

manifestations

• Recognize and diagnose syndromes with chromosome 22q11 deletion

and manage their cardiovascular manifestations

• Recognize and diagnose Ellis-van Creveld syndrome and manage its

cardiac manifestations

**Connective tissue diseases (including Marfan syndrome)**

• Recognize cardiovascular involvement in a patient with collagen vascular

disease and plan appropriate management

• Recognize and diagnose Marfan and related syndromes (eg, Loeys-Dietz

syndrome, congenital contractural arachnodactyly) and manage their

cardiovascular manifestations

• Recognize and diagnose the cardiovascular manifestations of the classical

and vascular forms of Ehlers-Danlos syndrome and manage their

cardiovascular manifestations

• Recognize and diagnose hereditary hemorrhagic telangiectasia (Osler-

Rendu-Weber syndrome)

**Hematologic diseases**

• Recognize and manage the cardiovascular manifestations of sickle cell

disease

• Recognize and diagnose thalassemia syndromes and manage their

cardiovascular manifestations

**Tuberous sclerosis and neurofibromatosis**

• Recognize and diagnose tuberous sclerosis and manage its

cardiovascular manifestations

• Recognize and diagnose neurofibromatosis and manage its

cardiovascular manifestations

**Familial atrial myxoma**

• Recognize and diagnose familial atrial myxoma and manage its

cardiovascular manifestations

**Congenital Heart Disease in the Adolescent and Adult**

A. Transitional care

• Understand the importance of transitional education and timing

• Be able to inform patients regarding health care insurance issues related

to their disease

• Be able to advise patients to regarding access to their medical records

during transition

• Be able to advise patients regarding family planning issues

**Pregnancy**

• Know how to counsel an adolescent/adult with congenital heart disease

regarding contraception and pregnancy

• Know the cardiovascular conditions that increase risk and those that are

contraindications to pregnancy

• Know how to manage cardiac aspects of pregnancy

• Manage artificial valves during pregnancy

**Cardiac risk of long-standing systemic disease**

• Recognize and manage chronic cyanosis in a patient with pulmonary

vascular obstructive disease

• Recognize the changes in arrhythmia risk as patients with CHD age, and

understand the basic principles of risk stratification

**Collateral disease associated with long-standing CHD**

• Recognize and be able to treat collateral disease associated with longstanding

CHD

**Psychosocial issues**

• Understand appropriate employment settings for an adolescent/young

adult with cardiovascular disease

• Identify risk-taking behaviors with magnified negative consequences in an

adolescent/young adult with cardiovascular disease Preventive cardiology

**Core Knowledge in Scholarly Activities**

**A. Principles of use of biostatistics in research**

**1. Types of variables**

• Distinguish types of variables (eg, continuous, categorical, ordinal,

nominal)

• Understand how the type of variable (eg, continuous, categorical,

nominal) affects the choice of statistical test

**2. Distribution of data**

• Understand how distribution of data affects the choice of statistical

test

• Differentiate normal from skewed distribution of data

• Understand the appropriate use of the mean, median, and mode

• Understand the appropriate use of standard deviation

• Understand the appropriate use of standard error

**3. Hypothesis testing**

• Distinguish the null hypothesis from an alternative hypothesis

• Interpret the results of hypothesis testing

**4. Statistical tests**

• Understand the appropriate use of the chi-square test versus a ttest

• Understand the appropriate use of analysis of variance (ANOVA)

• Understand the appropriate use of parametric (eg, t-test, ANOVA)

versus non-parametric (eg, Mann-Whitney U, Wilcoxon) statistical

tests

• Interpret the results of chi-square tests

• Interpret the results of t-tests

• Understand the appropriate use of a paired and non-paired t-test

• Determine the appropriate use of a 1- versus 2-tailed test of

significance

• Interpret a p-value

• Interpret a p-value when multiple comparisons have been made

• Interpret a confidence interval

• Identify a type I error

• Identify a type II error

**5. Measurement of association**

• Differentiate relative risk reduction from absolute risk reduction

• Calculate and interpret a relative risk

• Calculate and interpret an odds ratio

• Interpret a hazard ratio

• Understand the uses and limitations of a correlation coefficient

**6. Regression**

• Identify when to apply regression analysis (eg, linear, logistic)

• Interpret a regression analysis (eg, linear, logistic)

• Identify when to apply survival analysis (eg, Kaplan-Meier)

• Interpret a survival analysis (eg, Kaplan-Meier)

**7. Diagnostic tests**

• Recognize the importance of an independent "gold standard" in evaluating

a diagnostic test

• Calculate and interpret sensitivity and specificity

• Calculate and interpret positive and negative predictive values

• Understand how disease prevalence affects the positive and negative

predictive value of a test

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• Calculate and interpret likelihood ratios

• Interpret a receiver operator characteristic curve

• Interpret and apply a clinical prediction rule

• Systematic reviews and meta-analysis

• Understand the purpose of a systematic review

• Understand the advantages of adding a meta-analysis to a systematic

review

• Interpret the results of a meta-analysis

• Identify the limitations of a systematic review

• Identify the limitations of a meta-analysis

**B. Principles of epidemiology and clinical research design**

**1. Study types**

• Distinguish between Phase I, II, III, and IV clinical trials

• Recognize a retrospective study

• Understand the strengths and limitations of retrospective studies

• Recognize a case series

• Understand the strengths and limitations of case series

• Recognize a cross-sectional study

• Understand the strengths and limitations of cross-sectional studies

• Recognize a case-control study

• Understand the strengths and limitations of case-control studies

• Recognize a longitudinal study

• Understand the strengths and limitations of longitudinal studies

• Recognize a cohort study

• Understand the strengths and limitations of cohort studies

• Recognize a randomized-controlled study

• Understand the strengths and limitations of randomized-controlled studies

• Recognize a before-after study

• Understand the strengths and limitations of before-after studies

• Recognize a crossover study

• Understand the strengths and limitations of crossover studies

• Recognize an open-label study

• Understand the strengths and limitations of open-label studies

• Recognize a post-hoc analysis

• Understand the strengths and limitations of post-hoc analyses

• Recognize a subgroup analysis

• Understand the strengths and limitations of subgroup analyses

**2. Bias and confounding**

• Understand how bias affects the validity of results

• Understand how confounding affects the validity of results

• Identify common strategies in study design to avoid or reduce bias

• Identify common strategies in study design to avoid or reduce confounding

• Understand how study results may differ between distinct sub- populations

(effect modification)

**3. Causation**

• Understand the difference between association and causation

• Identify factors that strengthen causal inference in observational studies

(eg, temporal sequence, dose response, repetition in a different

population, consistency with other studies, biologic plausibility)

**4. Incidence and prevalence**

• Distinguish disease incidence from disease prevalence

**5. Screening**

• Understand factors that affect the rationale for screening for a condition or

disease (eg, prevalence, test accuracy, risk-benefit, disease burden,

presence of a presymptomatic state)

**6. Decision analysis**

• Understand the strengths and limitations of decision analyses

• Interpret a decision analysis

**7. Cost-benefit, cost-effectiveness, and outcomes**

• Differentiate cost-benefit from cost-effectiveness analysis

• Understand how quality-adjusted life years are used in cost analyses

• Understand the multiple perspectives (eg, of an individual, payor, society)

that influence interpretation of cost-benefit and cost- effectiveness

analyses

**8. Sensitivity analysis**

• Understand the strengths and limitations of sensitivity analysis

• Interpret the results of sensitivity analysis

**9. Measurement**

• Understand the types of validity that relate to measurement (eg, face,

construct, criterion, predictive, content)

• Distinguish validity from reliability

• Distinguish internal from external validity

• Distinguish accuracy from precision

• Understand and interpret measurements of interobserver reliability (eg,

kappa)

• Understand and interpret Cronbach alpha

**Applying research to clinical practice**

1. Assessment of study design, performance, and analysis (internal validity)

• Recognize when appropriate control groups have been selected for a

case-control study

• Recognize when appropriate control groups have been selected for a

cohort study

• Recognize the use and limitations of surrogate endpoints

• Understand the use of intent-to-treat analysis

• Understand how sample size affects the power of a study

• Understand how sample size may limit the ability to detect adverse events

• Understand how to calculate an adequate sample size for a controlled trial

(eg, clinically meaningful difference, variability in measurement, choice of

alpha and beta)

2. Assessment of generalizability (external validity)

• Identify factors that contribute to or jeopardize generalizability

• Understand how non-representative samples can bias results

• Assess how the data source (eg, diaries, billing data, discharge diagnostic

code) may affect study results

3. Application of information for patient care

• Estimate the post-test probability of a disease, given the pretest probability

of the disease and the likelihood ratio for the test

• Calculate absolute risk reduction

• Calculate and interpret the number-needed-to-treat

• Distinguish statistical significance from clinical importance

4. Using the medical literature

• Given the need for specific clinical information, identify a clear, structured,

searchable clinical question

• Identify the study design most likely to yield valid information about the

accuracy of a diagnostic test

• Identify the study design most likely to yield valid information about the

benefits and/or harms of an intervention

• Identify the study design most likely to yield valid information about the

prognosis of a condition

**Principles of teaching and learning**

1. Educational theory

• Understand the basic principles of adult learning theory (eg, adult learners

are self-directed, goal-oriented, practical; need to feel respected, build on

life experiences; learn best when learning is based on an existing

framework)

• Understand the attributes of an effective learning environment

• Understand the importance of "reflective practice" in teaching and learning

• Identify strategies that motivate learners

• Recognize the impact of the "hidden curriculum" on learning

2. Feedback and evaluation

• Identify components of effective feedback

• Distinguish between formative and summative feedback

• Distinguish between evaluation and feedback

• Understand the strengths and weaknesses of various methods to evaluate

learners

3. Teaching methods

• Understand the strengths and weaknesses of various teaching methods

(eg, lecture, small group discussion, bedside teaching, simulation)

• Understand that individuals may learn more effectively with certain

teaching methods (eg, reading, hearing, doing) than with others

4. Educational planning

• Understand the role of needs assessment in educational planning

• Distinguish between goals and learning objectives

• Identify components of well-formulated learning objectives

• Recognize the strengths and weaknesses of various educational outcome

measures (eg, participant satisfaction, acquisition of knowledge and skills,

behavioral change, patient outcomes)

Ethics in research

1. Conflicts of interest and commitment

• Evaluate whether an investigator has a conflict of interest during the

course of a study

• Understand ways to manage a conflict of interest

• Understand what constitutes a conflict of commitment

2. Professionalism and misconduct in research

• Identify forms of research misconduct (eg, plagiarism, fabrication,

falsification)

• Differentiate honest error and differences of opinion from research

misconduct

• Understand the criteria for authorship of clinical research publications

3. Principles of research with human subjects

• Understand and apply the three main principles of research ethics

articulated in the Belmont Report (eg, respect for persons, beneficence,

and justice)

• Understand the role of analysis of risks and benefits in the ethical conduct

of research

• Understand the federal regulatory definitions regarding which activities are

considered research

• Understand the federal regulatory definitions regarding when research

includes the use of human subjects

• Understand the federal regulatory definition of minimal risk

• Understand the functions of an Institutional Review Board

• Understand when an exemption from review by the Institutional Review

Board is permissible

• Understand the functions of a Data Safety Monitoring Board

• Understand the importance of clinical equipoise in research with human

subjects

• Understand the impact of "therapeutic misconception" on clinical research

with human subjects

• Understand the ethical considerations of study design (eg, placebo, harm

of intervention, deception, flawed design)

4**.** Principles of consent and assent

• Understand what constitutes informed consent in research

• Understand how undue influence can affect obtaining consent for research

• Understand how coercion can affect obtaining consent for research

• Understand the special ethical considerations related to research utilizing

children because of their inability to give informed consent

• Distinguish among consent, assent, and permission in research involving

children

5. Vulnerable populations

• Recognize that the definition of "children" is related to the underlying

clinical intervention in the jurisdiction in which the child is located rather

than a fixed nationwide notion of age

• Recognize the types of protections that might be accorded to vulnerable

populations (eg, incarcerated individuals, pregnant women, fetuses,

children, mentally disabled individuals, educationally or economically

disadvantage individuals)

• Understand the concept of minimal risk as it applies to research involving

children

• Understand the circumstances under which research that involves children

and that entails greater than minimal risk may be permissible

**Biostatistics, Research Methodology and Clinical Epidemiology**

**Ethics**

**Medico legal aspects relevant to the discipline**

**Health Policy issues as may be applicable to the discipline**

**Competencies**

• Be able to perform a reliable and appropriate examination

• Be able to examine children in an appropriate manner

• Behaviours Respect patients’ dignity and confidentiality

• Acknowledge cultural issues

• Involve relatives appropriately

• Appreciate the need for a chaperone

-Planning surgical strategies for specific congenital heart disease - indication/timing

- pre operative and post- operative management of CHD :in CICU and LLong term follow up

**LOG BOOK**

A candidate shall maintain a log book of operations (assisted / performed) during

the training period, certified by the concerned post graduate teacher / Head of

the department / senior consultant.

This log book shall be made available to the board of examiners for their perusal

at the time of the final examination.

The log book should show evidence that the before mentioned subjects were

covered (with dates and the name of teacher(s) The candidate will maintain the

record of all academic activities undertaken by him/her in log book .

1. Personal profile of the candidate

2. Educational qualification/Professional data

3. Record of case histories

4. Procedures learnt

5. Record of case Demonstration/Presentations

6. Every candidate, at the time of practical examination, will be required to

produce performance record (log book) containing details of the work done by

him/her during the entire period of training as per requirements of the log

book. It should be duly certified by the supervisor as work done by the

candidate and countersigned by the administrative Head of the Institution.

7. In the absence of production of log book, the result will not be declared.

**EXAMINATION**

The performance of the resident during the training period should be monitored

throughout the course and duly recorded in the log books as evidence of the

ability and daily work of the student

**1. Personal attributes:**

• **Behavior and Emotional Stability:** Dependable, disciplined, dedicated,

stable in emergency situations, shows positive approach.

• **Motivation and Initiative:** Takes on responsibility, innovative,

enterprising, does not shirk duties or leave any work pending.

• **Honesty and Integrity:** Truthful, admits mistakes, does not cook up

information, has ethical conduct, exhibits good moral values, loyal to the

institution.

• **Interpersonal Skills and Leadership Quality:** Has compassionate

attitude towards patients and attendants, gets on well with colleagues and

paramedical staff, is respectful to seniors, has good communication skills.

**2. Clinical Work:**

• **Availability:** Punctual, available continuously on duty, responds promptly

on calls and takes proper permission for leave.

• **Diligence:** Dedicated, hardworking, does not shirk duties, leaves no work

pending, does not sit idle, competent in clinical case work up and

management.

• **Academic ability:** Intelligent, shows sound knowledge and skills,

participates adequately in academic activities, and performs well in oral

presentation and departmental tests.

• **Clinical Performance:** Proficient in clinical presentations and case

discussion during rounds and OPD work up. Preparing Documents of the

case history/examination and progress notes in the file (daily notes, round

discussion, investigations and management) Skill of performing bed side

procedures and handling emergencies.

**3. Academic Activity:** Performance during presentation at Journal club/

Seminar/ Case discussion/Stat meeting and other academic sessions.

Proficiency in skills as mentioned in job responsibilities.

One paper publication+oral presentation /paper

**FINAL EXAMINATION**

The summative assessment of competence will be done in the form of Final

Examination.

**a) Practical Examination:**

1. Maximum Marks: 300.

2. Comprises of Clinical Examination and Viva.

3. Candidate must obtain a minimum of 50% marks in the Clinical

Examination (including Viva) to qualify for the Practical Examination.

**RECOMMENDED TEXT BOOKS AND JOURNALS**

**BOOKS**

• Moss & Adams' Heart Disease in Infants, Children, and Adolescents:

Including the Fetus and Young Adult

• Pediatric Cardiology - Springer

• Nadas' Pediatric Cardiology -

• Pediatric Cardiology and Cardiovascular Surgery:

• Elsevier: Park's The Pediatric Cardiology Handbook, 5th Edition: Park

• How to Read Pediatric ECGs - 9780323035705 | US Elsevier Healt

• Fundamentals of Pediatric Cardiology**:** David J Driscoll MD

• Pediatric Cardiovascular Medicine, 2nd Edition

• James H. Moller (Editor), Julien I. E. Hoffman (Editor)

• Concise Guide to Pediatric Arrhythmias by Christopher Wren

• Pediatric Cardiology Board Review, 2e *By Benjamin W. Eidem, Bryan C.*

*Cannon, Anthony C. Chang, Frank Cetta and Jonathan N. Johnson*

• Practical Pediatric Cardiology

• Case-Based Management of Potential Pitfalls

• Editors: Magee, Alan G., Till, Jan, Seale, Anna N. (Eds.)

• Pediatric and Congenital Cardiology, Cardiac Surgery and Intensive

Care

• Editors: da Cruz, Eduardo, Ivy, Dunbar, Jaggers, James (Ed

• IAP Specialty Series on Pediatric Cardiology

• Pediatric Practice: Cardiology

• Marie Murphy Gleason, Jack Rychik, Robert Shaddy

• Pediatric Cardiology: Requisites (Requisites in Pediatrics) 1st Edition

• by Victoria L. Vetter

• Echocardiography in Pediatric and Congenital Heart Disease: From Fetus

to Adult, 2nd Edition

• Wyman W. Lai, Luc L. Mertens, Meryl S. Cohen, Tal Geva

• Pediatric ECG Interpretation: An Illustrative Guide

• Barbara J. Deal, M.D., Christopher L. Johnsrude, M.D., Scott H. Buck,

M.D.

• Congenital Diseases of the Heart: Clinical-Physiological Considerations,

3rd Edition

• Abraham Rudolph

• Illustrated FIELD GUIDE to Congenital Heart Disease and Repair

• Fundamentals of Pediatric Cardiology David J Driscoll MD

• *By Allen D. Everett and D. Scott Lim, MD* New

• Insight in Pediatric Cardiology: From Basic to Therapeutics by

Giuseppe Santoro, Giuseppe Pacileo, Maria Giovanna Russo

• The Science and Practice of Pediatric Cardiology Hardcover – Import, 1

Jan 1998 by Arthur Garson (Editor), etc. (Editor), Jonathan Pin

• Manual of Pediatric Cardiac Intensive Care – 2012 by Luthra (Author)

**JOURNALS**

• Pediatric Cardiology

• Progress in Pediatric Cardiology

• Annals of Pediatric Cardiology

• Cardiology in the Young | Cambridge Core

• Congenital Heart Disease and Pediatric Cardiology

• Progress in Pediatric Cardiology World Journal for Pediatric and

Congenital Heart Surgery

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