**UEMS Section of Cardiothoracic Surgery**

**CARDIAC/CARDIOTHORACIC/CARDIOVASCULAR SURGERY**

**SYLLABUS**

**Physiology**

Myocardial cellular physiology

Electrophysiology

Physiology of congestive heart failure

**Anatomy**

Heart, pericardium and great vessels

Coronary anatomy

Valvular anatomy

Anatomy of the peripheral vascular system

Anatomy of cardiac innervation

**Pathology**

Atheroma, medial necrosis

Myocardial infarction and complications

 Intrinisic myocardial disorders

Endocarditis

Pericarditis

Tumors of the heart

 Sequelae of chest wall and mediastinal radiation

**Pharmacology**

Drugs used in the treatment of hypertension, heart failure, and angina

Inotropes, vasodilators and vasoconstrictors

Anticoagulants, antiplatelet drugs

**Microbiology**

Antibiotic prophylaxis for cardiac surgery

**Imaging**

Echo

Cardiac cath

CT-SCAN

MRI

**General Patient Management**

Diagnosis, evaluation and treatment of heart disease

Risk assessment (including when not to operate)

Cardiopulmonary resuscitation (open chest)

Cardiac arrhythmias – diagnosis and management

Cardiac rehabilitation

Management of complications of cardiac surgery

Median sternotomy

Peripheral arterial and venous cannulation technique

Wound infection and sternal disruption

Cardiac tamponade

Interpretation of:

 Hemodynamic data

 ECG including exercise data

 Coronary angiography

 Cardiac cath hemodynamics

 Echo including 2D, Doppler and transthoracic, stress echo

 Nuclear cardiology

 Cardiac MRI

 CT angiography

**CARDIOPULMONARY BYPASS, MYOCARDIAL PROTECTION, AND CIRCULATORY SUPPORT**

Metabolic response to CPB

Temperature regulation

Principles of myocardial preservation

Physiology of balloon pump

Anatomy of femoral triangle and thoracic inlet and neck

Principles and practice of CPB

Relevant equipment and technology and its application

Monitoring during CPB

Priming fluids and hemodilution

Acid base balance – pH and alpha stat

Neuropsychological consequences of CPB

Cell salvage and blood conservation

Cardioplegia solutions and delivery modes

Noncardioplegic techniques of preservation

Intra-cardiac balloon pump – indications for use, patient selection and complications

Coordination of perfusionist, anesthesiologist, and surgeon

Patient selection for mechanical circulatory support

Management of balloon pump

Weaning from bypass and decannulation

 Recognize and manage acute complications of CPB

 Cannulation and institution of CPB

Repeat sternotomy with pericardial dissection, cardiac mobilization

Femoral or axillary cannulation and decannulation

**ISCHEMIC HEART DISEASE**

Diagnosis, investigation and treatment of ischemic heart disease

Results of surgery: survival, graft patency, recurrence

Guidelines for myocardial revascularization

Arterial revascularization

Role of PCI and nonoperative treatment

Hybrid approaches

Complication of MI and ischemic heart disease: VSD, mitral regurgitation, aneurysm

On and off pump techniques

Preop cardiovascular assessment including general history and exam, conduit

 assessment, drug history, comorbidities, and risk assessment

Imaging interpretation

Postop management including complications

Mammary artery/radial artery harvest, venous conduit procurement

Proximal and distal coronary anastomosis

Repeat coronary artery surgery

Minimally invasive conduit procurement

Combined coronary and carotid intervention

**HEART VALVE DISEASE**

Anatomy of cardiac chambers and valves

Valve physiology and hemodynamics

Calculation of valve area and regurgitant fraction

Pathophysiology of valve incompetence and stenosis

Consequences of valve disease on cardiac function and morphology

Pathophysiology of mixed valve disease and combined valve pathology

Diagnosis, investigation and assessment of valvular heart disease

Determination of need and timing of surgical intervention valve disease

Cardiovascular system and general history and exam including drug history, identification of comorbidity and risk assessment

Echo interpretation (thoracic and transesophageal)

Combined valvular and ischemic heart disease

Endocarditis and prosthetic valve endocarditis

Indications for operative management including: valve replacement/repair (mechanical, biologic stented and stentless grafts, homografts and autografts)

Guidelines for valvular heart disease and endocarditis

Valve design: materials, anticoagulation and biomechanics

Results of surgery – survival, long-term functional status, valve thrombosis, endocarditis, bleeding

Alternative surgical approaches to valve surgery including thoracotomy, transseptal/transapical approaches, minimal access surgery, and percutaneous approaches

Management of postop heart valve patient including complications

Medical management of endocarditis

Valve selection

Long-term anticoagulation and antibiotic prophylactic guidelines

Aortic valve and root surgery: repair and replacement

Mitral valve surgery: repair and replacement

Tricuspid valve surgery: repair and replacement

Pulmonary valve and right ventricular outflow tract surgery: repair and replacement

Combined valve and graft surgery

Surgical strategies for managing small aortic root

**GREAT VESSEL DISEASE**

Vascular pathology (including atherosclerosis, inherited and acquired disorders)

Blood supply of the spinal cord

Spinal cord and cerebral preservation

Traumatic aortic transection

Results of surgery – survival, complication rates

Role of endovascular stenting

Medical management of great vessel disease

Knowledge of thromboembolic disease

Interpretation of CT scan, MRI, aortography

Medical management of great vessel disease

Selection of patients for surgery

Management of postop patients including complications

Medical and surgical management of venous obstructive disease

Medical and surgical management of acute and chronic pulmonary embolic disease

Intraoperative monitoring

Spinal cord and cerebral protection

Bypass and non-CPB strategies for major aortic surgery

Surgery for acute dissection of thoracic aorta

Aortic root replacement for acute and chronic aortic root disease

Complex aortic surgery, including aortic arch surgery, descending aortic and thoraco-abdominal aortic surgery

Endovascular stenting

Pulmonary embolectomy

Great vessel venous reconstruction

**PERIPHERAL VASCULAR DISEASE**

Vascular exam (including interpretation of ankle: brachial index)

Diagnosis and management of DVT

Diagnosis and management of acute limb ischemia

Diagnosis and management of visceral ischemia

Carotid artery disease and transient ischemic attacks

Aneurysmal disease

Leg ulceration

Atherosclerotic arterial disease

 - aortic

 - acute and chronic limb ischemia

 Embolic and thrombotic arterial disease

Venous insufficiency

Diabetic ulceration

Pseudoaneurysms

Complication of vascular access

Saphenous vein harvest

Vascular anastomosis

Embolectomy

Fasciotomy

**CARDIAC CONDUCTION SYSTEM DISORDERS**

Anatomy of normal conduction pathways

Anatomy and influence of sympathetic and parasympathetic nervous system on cardiac conduction

Characteristics of atrial conduction disorders (sinus node dysfunction, atrial flutter, atrial fibrillation, Wolf-Parkinson-White syndrome, AV Node Reentry)

Characteristics of ventricular conduction disorders [ventricular tachycardia (monomorphic vs. polymorphic), ventricular fibrillation, left bundle branch block, right bundle branch block]

Risk factors for post-operative atrial fibrillation

Adverse consequences of atrial and ventricular arrhythmias and current medical therapies

Indications for pacemaker placement for atrial and ventricular disorders

Indications and timing for automatic implantable cardiac defibrillators

Indications for epicardial lead placement

Indications for cardiac resynchronization therapy

Complications of intravascular leads (perforation, infection, great vessel stenosis)

Indications for and complications of catheter ablation

Select appropriate patient and lesion set for lone and concomitant surgery for atrial fibrillation and define the success rates

Manage anti-coagulation and anti-arrhythmic medication after surgery for atrial fibrillation

Manage post-operative atrial fibrillation

Complications of transvenous lead extraction

Determine the need for emergent operation after complications of ablation and lead extraction

Select appropriate patients for the surgical treatment of cardiac dysrhythmias

Manage temporary cardiac pacing in the peri-operative setting

Implantation of pacemakers and leads

Atrial fibrillation operation

**DISEASES OF THE PERICARDIUM AND MYOCARDIUM. CARDIAC TUMORS**

Anatomy of the pericardium

Pathology of the pericardium (benign, malignant, inflammatory)

Pathophysiological consequences of pericardial constriction and tamponade

Clinical and imaging techniques used to detect pericardial disease

 Pericarditis (primary and post pericardiotomy)

Needle aspiration of pericardial fluid with echo guidance

Pericardial window (subxiphoid, thoracoscopic approach)

Pericardiectomy for relief of constriction

Materials used for pericardial replacement

Complications following pericardial surgery

Indications for pericardial reconstruction

Interpretation of laboratory, physiological and imaging techniques, including echo

Recognition and assessment of pericardial tamponade and constriction

Recognition of pericardial herniation and cardiac strangulation

Postop management of patients following pericardial surgery

Benign and malignant cardiac tumors

Management of cardiac tumors

 Diagnosis and management of HOCM

**HEART FAILURE AND CARDIAC TRANSPLANTATION**

Etiology and natural history of heart failure

Modes of action and interaction of commonly used drugs in heart failure

Evaluation and management of advanced heart failure

Indications for acute and chronic mechanical assistance

Pathophysiology of nonpulsatile flow

Cardiovascular and general history and exam: preoperative assessment for cardiac transplantation

Indications and assessment for heart transplantation

Acute and chronic cardiac rejection

Results of heart transplantation and non-transplant interventions for heart failure

Management of brain-dead donor

Donor retrieval

Management of postoperative transplant patient including complications

Immunossupressant therapy

Diagnosis and treatment of device failure

Management of acute post-cardiotomy heart failure

Cardiac transplantation technique

Surgical revascularization for ischemic cardiomyopathy

Ventricular remodeling surgery

Mitral valve repair for heart failure

Provision and management of acute mechanical ventricular support

Extracorporeal and intracorporeal ventricular assistance devices

**CARDIOTHORACIC TRAUMA**

The mechanism and patterns of injury associated with blunt, penetrating, and

 deceleration injuries to the chest

Indications and use of appropriate investigations in thoracic trauma management

Indications for thoracotomy in trauma

Care of blunt, penetrating and deceleration injuries to the chest

Diagnosis and management of immediately life threatening situations:

 obstructed airway, tension pneumothorax, massive hemothorax, open

 chest wound, flail chest, and cardiac tamponade

Diagnosis and assessment of potentially life threatening situations:

 lung contusion, bronchial rupture, blunt cardiac injury, intrathoracic bleeding,

 esophageal injury, simple pneumothorax and major vascular injury

Pericardiocentesis and subxiphoid window for tamponade

Various approaches to expose thoracic trauma

Repair of cardiac injuries

Repair of aortic transection

Repair of other great vessel injuries

**PRINCIPLES OF THORACIC SURGERY**

Open versus minimally invasive approaches to thorax

Early and late complications of thoracic incisions

Management of post-thoracic surgical complications

Postoperative management of pain control

Treatment of cardiac arrhythmias

Physiotherapy and rehabilitation

Understanding thoracic-specific ventilatory techniques (e.g., lung isolation)

Introduction to benign and malignant tumors of trachea, bronchus, lung

Principles of lung resections

 Etiology, pathology and physiology of COPD

Smoking cessation measures and outcome

 Interpretation of pulmonary function tests

Chest drains insertion, management, removal

Introduction to congenital, benign, infectious and malignant (primary and secondary) conditions of the mediastinum

**CONGENITAL HEART DISEASE**

**Physiology**

Hemodynamics; physiology and measurement including shunt calculations, PVR, SVR determinations

 Physiology of Left-to-Right shunts and Right-to-Left shunts

 Physiology of pulmonary vasculature and changes with development

Basic conduction disorders

Acid base balance (including Ph stat and alpha stat CPB mgmt)

Physiology of pediatric cardiopulmonary bypass including hypothermia, low-flow, and circulatory arrest.

**Anatomy**

Basic embryology of the heart, lungs, great vessels

Coronary anatomy and variants

Location and course of the conduction system in congenital heart disease

Anatomy as it pertains to vascular conduits including aortopulmonary shunts

Basic anatomy of atrial septum and ventricular septum

Basic concepts of cardiac position, situs, atrioventricular and ventriculoarterial connections

**Pathophysiolology**

Basic concepts of volume and pressure overload

Mechanisms of cyanosis

Manifestations of congestive heart failure in infants and children

**Pharmacology**

Specific drugs used in the treatment of congenital heart disease (beta blockers, ACE inhibitors, Digoxin, Diuretics, PGE1, nitric oxide, systemic vasodilators)

Specific dosing and application

General indications and use of inotropes, anti-arrhythmic drugs, hemostatic drugs,

antiplatelet, anticoagulant and thrombolytic drugs, analgesics, antibiotics,

anesthetic agents, and vasodilators (systemic and pulmonary) in the pediatric

population

**Congenital Heart Disease**

Data Interpretation

 Routine hematology and biochemical investigations

 Chest radiograph and ECG

 Cardiac catheterization data including interpretation of hemodynamic data, shunt and

 resistance calculation

 Basic congenital heart disease imaging (Echo, MRI, CT) interpretation

Diagnosis, assessment, and treatment of common congenital heart disease

Collaborative and complementary role of interventional cardiology

Risk assessment and stratification

Basic pediatric intensive care to include ventilator management

Perioperative management of adults and children following congenital heart surgery

Mechanical assist (IABP, VAD, ECMO)

Indications for heart or lung transplantation referral

Management of complications of surgery

Cardiopulmonary resuscitation

Diagnosis and treatment of common congenital cardiac arrhythmias

Wound infection and sternal dehiscence

Sternotomy

Thoracotomy

Preparation for and management of cardiopulmonary bypass including partial bypass

Basic ECMO techniques, cannulation, and management.

Anatomy, pathophysiology, natural history, management, and results of the following conditions or procedures:

Patent ductus arteriosus

Atrial septal defect

Ventricular septal defect

Coarctation

PA banding and shunts

Transposition of the great arteries/arterial switch procedure

Tetralogy of Fallot

Vascular ring

Functional single ventricle leading to single ventricle pathway and principles of treatment (Fontan procedure)

Congenital aortic stenosis/insufficiency (Konno, Ross procedure)

Rastelli procedure

Hypoplastic left heart and Norwood procedure

Truncus arteriosus

Double outlet right ventricle

VSD, Pulmonary atresia, and MAPCAs

Pulmonary atresia and intact septum

Partial and complete atrioventricular septal defects

Mitral valve disease

Tricuspid valve disease including Ebstein’s anomaly

Interrupted aortic arch

Total anomalous pulmonary venous drainage

Extra Corporeal Membrane Oxygenation

Transplantation – Heart and Lung