

A. Atrial Septal Defect

Contents:

- Anatomy
 - types of Atrial Septal defects and key landmarks of the right atrium
- Clinical Features
 - natural history, indications for operation
 - clinical signs and symptoms, physical exam
 - chest x-ray and ECG
 - echocardiogram and cardiac catheterization
- Operative Repair and Complications
 - extracorporeal bypass and myocardial protection
 - incisions in the heart
 - techniques for defect closure
 - treatment of associated anomalies (e.g., cleft mitral valve)
 - complications of closure (e.g., air embolism, conduction abnormalities, residual defects)
- Outcome
 - expected operative mortality
 - long-term results
 - complications

B. Ventricular Septal Defect

- Anatomy
 - types
- Clinical Features
 - clinical signs and symptoms, physical exam
 - echocardiogram and cardiac catheterization
 - chest x-ray and ECG
 - natural history
 - indications, contraindications, timing of operation (e.g., total repair vs. pulmonary artery banding)
- Operative Repair and Complications
 - extracorporeal bypass and myocardial protection
 - incisions for different types of defects
 - closure techniques (direct suture vs. patch)
 - treatment of associated anomalies (e.g., Atrial Septal defect, right ventricular muscle bands)
 - complications (rhythm disturbances, residual defects, air)
 - techniques of PA banding
- Outcomes
 - expected operative mortality
 - long-term results
 - complications

C. Patent Ducts Arteriosus

- Anatomy
- Physiology
 - neonate vs. older child
 - effect of prostaglandin and prostaglandin inhibitors
- Diagnosis and Clinical Features
 - symptoms and physical findings
 - echocardiogram and cardiac catheterization
 - chest x-ray and ECG
 - natural history (neonate vs. older child, endocarditis)
 - indications for operation
 - associated anomalies (e.g., ductus-dependent conditions)

- Operative Repair and Complications
 - operative techniques for simple ductus
 - management of the difficult ductus
 - complications of operative repair

- Outcome
 - expected operative mortality
 - long-term results
 - complications

D. Atrioventricular Septal Defect

- Anatomy
 - types (complete, transitional, ostium primum ASD)
 - atrioventricular valve pathologic anatomy
- Physiology
 - shunts and resistance calculation
 - complete vs. incomplete
- Diagnosis and Clinical Features
 - Symptoms and signs (infant vs. older patient, physical exam)
 - echocardiogram, angiocardiograms, cardiac catheterization
 - chest x-ray and ECG
 - natural history (development of Eisenmenger's syndrome)
 - indications for and timing of operation (size of shunt, endocarditis risk, total repair vs. pulmonary artery banding)
- Operative Repair and Complications
 - cardiopulmonary bypass and myocardial protection
 - incisions in the heart
 - operative techniques
 - complications (residual defects, residual "mitral valve" insufficiency, heart block)
- Outcome
 - expected operative mortality
 - long-term results
 - complications

E. Double-Outlet Right Ventricle

- Anatomy
 - types (sub aortic, subpulmonic, uncommitted)
 - associated anomalies
- Clinical Features
 - natural history
 - indications for and timing of operation
 - signs and symptoms of each of the anatomic types
 - chest x-ray, ECG
 - echocardiogram and cardiac catheterization
- Operative Repair and Complications
 - palliative operations vs. total repair (application of shunts, pulmonary artery band, total repair)
 - cardiopulmonary bypass and myocardial protection
 - approach to each anatomic subtype and placement of incisions in the heart
 - specific operative techniques (e.g., suturing, placement of patches)
 - complications and their management
 - outcome
- Outcome
 - expected operative mortality
 - long-term results
 - complications

F. Truncus Arteriosus

- Anatomy
 - types of truncus arteriosus
 - associated anomalies (VSD, left ventricular outflow tract obstruction, arch interruption, DiGeorge syndrome)
- Clinical Features
 - symptoms and physical findings
 - cardiac catheterization, echocardiogram, angiogram
 - chest x-ray, ECG
 - natural history (development of pulmonary vascular obstructive disease)
 - indications for and timing of operation
- Operative Repair and Complications
 - extracorporeal bypass and myocardial protection
 - operative techniques
 - conduits (composite and homograft)
 - modifications required for types II and III truncus
 - techniques for repair of associated anomalies
- Outcome

- expected operative mortality
- long-term results
- complications

G. Aorto-Pulmonary Window

- Anatomy
- Clinical Features
- Natural History (development of pulmonary vascular obstructive disease)
- Symptoms and Signs
- Echocardiogram, Angiogram, Cardiac Catheterization
- Chest X-ray, ECG
- Operative Repair
- Outcome

- expected operative mortality
- long-term results
- complications

CYANOTIC ANOMALIES

Summary:

To know the anatomy and physiology of anomalies that result in cyanosis, their diagnosis, their preoperative, operative, and postoperative management, and performs operative and non-operative treatment.

Objectives:

To know the methods of diagnosis and understand the:

- Role of medical management and interventional cardiology as treatment
- Indications for and timing of operation;
- Technical components of operative repair;
- Postoperative care, expected outcome, long-term results, and complications.

Contents:

A. Tetralogy of Fallot

- Anatomy and Embryology
 - embryology of malaligned ventricular septal defect
 - levels of right ventricular outflow tract obstruction
- Physiology
 - genesis of "tet spells" and infundibular spasm
 - factors which affect degree of right-to-left shunt
 - associated anomalies
- Clinical Features
 - symptoms and physical findings
 - cardiac catheterization, echocardiogram, angiogram
 - chest x-ray, ECG

- natural history
- indications for and timing of operation
- Operative Repair and Complications
 - role of systemic-to-pulmonary artery shunt vs. total repair
 - types of aortic-to-pulmonary artery shunts
 - extracorporeal bypass and myocardial protection
 - ventricular septal defect closure by transventricular or transatrial approach
 - techniques for relief of right ventricular outflow tract obstruction and indications for transannular patching
 - indications for conduit repair
- Outcome
 - expected operative mortality
 - long-term results
 - complications

B. Pulmonary Atresia with Ventricular Septal Defect

- Anatomy and embryology
 - embryology of pulmonary arteries
- Physiology
 - duct dependency and MAPCAs
- Clinical Features
 - symptoms and physical findings
 - cardiac catheterization, echocardiogram, angiocardiogram
 - chest x-ray, ECG
 - natural history
 - indications for and timing of operation
- Operative Repair and Complications
 - role of systemic-to-pulmonary artery shunt, unifocalization
 - RV to PA reconstruction, valved and non valved procedures
 - indications for septation
- Outcome
 - expected operative mortality
 - long-term results, complications

C. Transposition of the Great Vessels (TGA)

- Anatomy
 - simple TGA
 - complex TGA (ventricular septal defect, pulmonary stenosis)
- Physiology

- Concept of Circulations in Parallel and Mixing
- Clinical Features
 - symptoms and physical findings
 - echocardiogram, angiocardiogram, cardiac catheterization
 - chest x-ray, ECG
 - natural history, role of balloon atrial septostomy
 - indications for and timing of operations
- Operative Repair and Complications
 - technique of Blalock-Hanlon atrial septectomy, open atrial septectomy
 - cardiopulmonary bypass and myocardial protection
 - operative techniques for total repair (Mustard, Senning, arterial switch, Rastelli)
 - palliative operations (PA band, systemic-to-pulmonary artery shunt)
- Outcome
 - expected operative mortality
 - long-term results
 - complications
 - arrhythmias after atrial repairs
 - semilunar insufficiency, PA stenosis, coronary problems after arterial switch
 - conduit obstruction after Rastelli

D. Tricuspid Atresia

- Anatomy
 - types I and II, subtypes
- Physiology
 - subtypes with right-to-left shunt
 - subtypes with left-to-right shunt
- Clinical Features
 - symptoms and physical findings
 - echocardiogram, angiocardiogram, cardiac catheterization
 - chest x-ray, ECG
 - natural history, role of balloon atrial septostomy
 - indications for and timing of operation
 - role of palliative operations (systemic-pulmonary artery shunts, PA banding, bidirectional Glenn, Fontan, other right heart bypass operations)
- Operative Repair and Complications
 - palliative operations
 - operations for right heart bypass (bidirectional Glenn, Fontan)
- Outcome
 - expected operative mortality
 - long-term results
 - complications

E. Pulmonary Atresia and Pulmonary Stenosis, with Intact Septum

- Anatomy
- Physiology
 - Duct dependency
- Clinical Features
 - symptoms and physical findings
 - echocardiogram, angiocardiogram, cardiac catheterization
 - chest x-ray, ECG
 - natural history, role of balloon atrial septostomy
- Operative Repair and Complications
 - type of procedures (systemic-pulmonary artery shunts, surgical valvotomy, balloon valvuloplasty)
 - further operations (bidirectional Glenn, Fontan, partial right heart bypass operations)
- Outcome
 - expected operative mortality
 - long-term results, complications

F. Total Anomalous Pulmonary Venous Connection

- Anatomy
 - supracardiac, cardiac, infracardiac, mixed
- Physiology
 - obstructive vs. nonobstructive
- Clinical Features
 - symptoms and physical findings
 - cardiac catheterization, echocardiogram, angiocardiogram
 - chest x-ray, ECG
 - natural history
 - indications for and timing of operation
- Operative Repair and Complications
 - extracorporeal bypass, myocardial protection
 - operative techniques for different subtypes
- Outcome
 - expected operative mortality
 - long-term results
 - complications

G. Ebstein's Anomaly

- Anatomy
- Physiology
 - concept of atrialized ventricle
 - right ventricular outflow tract obstruction
- Clinical features
 - symptoms and physical findings
 - cardiac catheterization, echocardiogram, angiogram
 - chest x-ray, ECG
 - natural history
 - associated lesions (e.g., Wolf-Parkinson-White syndrome)
 - indications for and timing of operation
- Operative Repair and Complications
 - extracorporeal bypass and myocardial protection
 - technique of tricuspid repair, obliteration of atrialized ventricle
 - technique of tricuspid valve replacement
- Outcome
 - expected operative mortality
 - long-term results
 - complications

OBSTRUCTIVE ANOMALIES

Summary:

To know the anatomy and physiology of each anomaly;
 To know the methods of diagnosis in respect to:

- Role of medical management and interventional cardiology;
- Indications for and timing of operation
- Technical components of operative repair
- Principles of postoperative care
- Expected outcome, long-term results and complications

Contents:

A. Aortic Stenosis

- Anatomy
 - supra-aortic, valvular, sub-aortic (including subtypes)
- Physiology
- Associated Anomalies
- Clinical Features
 - symptoms and physical findings
 - cardiac catheterization, echocardiogram, angiogram
 - chest x-ray, ECG

- natural history
- Indications for and timing of operation
- Operative Repair and Complications
 - extracorporeal bypass, myocardial protection
 - operative techniques pros and cons of various techniques and patch configurations for supra-ventricular stenosis
 - techniques of aortic valvotomy
 - operations to enlarge the aortic annulus (e.g., Konno-Rastan procedure, Ross procedure)
 - technique of apical aortic conduit
 - myomectomy and myotomy for subaortic obstruction
- Outcome
 - expected operative mortality
 - long-term results
 - complications

B. Pulmonary Stenosis

- Anatomy
 - Valvular and supra-ventricular
 - associated anomalies (e.g., atrial septal defect, ventricular septal defect, branch stenosis)
- Clinical Features
 - symptoms and physical findings
 - echocardiogram, angiogram, cardiac catheterization
 - chest x-ray, ECG
 - natural history; role of balloon valvuloplasty
 - Indications for and timing of operation
- Operative Repair and Complications
 - extracorporeal bypass, myocardial protection
 - incisions in the heart and great vessels
 - operative considerations (technique of valvulotomy, indications for transannular patching, division of right ventricular muscle bands)
 - complications (residual obstruction)
- Outcome
 - expected operative mortality
 - long-term results
 - complications

C. Coarctation of the Aorta

- Anatomy
 - relationship to the ductus arteriosus
 - associated anomalies (e.g., hypoplasia of transverse aorta, patent ductus arteriosus, LVOT obstruction)

- Physiology
 - infant vs. older child
 - preductal vs. pareductal vs. postductal
 - assessment of adequacy of collateral circulation
- Clinical Features
 - symptoms and physical findings (neonate with a closing ductus vs. older infant and child)
 - echocardiogram, angiogram, cardiac catheterization
 - chest x-ray, ECG
 - natural history
 - Indications for and timing of operation
 - role of prostaglandins in stabilizing neonates
 - effect of associated anomalies (e.g., patent ductus arteriosus, aortic stenosis, ventricular septal defect)
- Operative Repair and Complications
 - methods of repair (end-to-end vs. patch vs. subclavian angioplasty)
 - methods of arch reconstruction
 - complications (residual obstruction, paraplegia, chylothorax)
 - extracorporeal bypass, shunts in the absence of adequate collateral circulation
- Outcome
 - expected operative mortality
 - long-term results
 - complications
 - re-coarctation

D. Interrupted Aortic Arch

- Anatomy
 - types A, B, and C
 - associated anomalies (e.g., DiGeorge syndrome, VSD)
- Physiology
 - role of ductal patency, prostaglandin
- Clinical Features
 - symptoms and physical findings
 - echocardiogram, angiogram, cardiac catheterization
 - chest x-ray, ECG
 - natural history
 - indications for and timing of operation
 - the role of prostaglandins in preoperative stabilization
 - DiGeorge syndrome (hypocalcemia, need for irradiated blood)
- Operative repair and complications
 - extracorporeal bypass, hypothermic arrest

- median sternotomy vs. left thoracotomy
- techniques (e.g., end-to-end anastomosis, interposition grafting, absorbable vs. nonabsorbable sutures)
- complications (e.g., residual obstruction, recurrent laryngeal nerve injury, chylothorax)
- repair of associated anomalies

➤ Outcome

- expected operative mortality
- long-term results
- complications
- reoperation
- management of DiGeorge syndrome

E. Vascular Ring

➤ Anatomy

- double aortic arch, anomalous subclavian artery, unusual rings, pulmonary artery sling

➤ Physiology

- compression of airway and esophagus

➤ Clinical Features

- signs and symptoms
- barium esophagogram, CT scan, MRI

➤ Operative Repair and Complications

- techniques for exposure by left thoracotomy, indications for other approaches
- technique for correction of each type
- role of aortopexy
- complications (e.g., recurrent laryngeal nerve paralysis, chylothorax, residual tracheomalacia)

➤ Outcome

- expected operative mortality
- long-term results
- complications
- residual tracheomalacia

MISCELLANEOUS ANOMALIES

Objectives:

- To understand the natural history, evaluation, and treatment of coronary anomalies, congenital complete heart block, hypoplastic left heart syndrome, pulmonary atresia (with and without VSD), corrected transposition, single ventricle, cor triatriatum, and cardiac tumors

- To understand the role of corrective and palliative operations for the above anomalies and of cardiac transplantation for appropriate cardiac pathology.

Contents:

- Coronary anomalies
- Hypoplastic left heart syndrome

TRACHEA CONGENITAL AND ACQUIRED ABNORMALITIES

Summary:

- To understand congenital abnormalities and idiopathic diseases of the trachea;
- To understand the etiology, presentation and management of acquired tracheal strictures and their prevention;
- To understand the etiology, presentation, diagnosis and management of tracheoesophageal fistulas;
- To know the operative approaches to the trachea and techniques of mobilization;
- To know the methods of airway management, anesthesia and ventilation for tracheal operations;
- To know the principles of tracheal surgery and release maneuvers;
- To understand the complications of tracheal surgery and their management;
- To understand the etiology, presentation, and principles of airway trauma management;
- To understand the radiologic evaluation of tracheal abnormalities.

Contents:

- Radiologic assessment of the trachea and bronchi
 - Barium swallow
 - Tracheo-bronchograms
 - Plain x-rays
 - CT scans
 - MRI
- Stricture of the Trachea
 - Congenital
 - Post-intubation
 - Post-tracheostomy
 - Post-traumatic
- Anesthesia for Tracheal Operations
 - Methods of airway control
 - Extubation concerns
- Operative Approaches to the Trachea
 - Reconstruction of the upper trachea
 - Reconstruction of the lower trachea
- Tracheostomy and its Complications

CONGENITAL ABNORMALITIES OF THE MEDIASTINUM

Objectives:

- To be able to diagnose mediastinal cysts;
- to be familiar with the symptoms associated with mediastinal abnormalities;
- To know the indications for operations involving the mediastinum and the anatomic approaches.
- To know how to read and interpret plain radiographs, CT scans, MRI's and contrast studies of congenital abnormalities of the mediastinum;
- To know how to diagnose and manage patients with congenital abnormalities of the mediastinum;
- To know how to perform operations for congenital abnormalities of the mediastinum

Contents:

- Mediastinal Cysts
- Pericardial Cysts
- Cystic Hygroma
- Bronchogenic Cysts
- Esophageal Duplications
- Operative and Non-Operative Management
- Symptoms of Mediastinal Abnormalities

ACQUIRED HEART DISEASE

VALVULAR HEART DISEASE

Summary:

- To understand the normal and pathologic anatomy of the atrioventricular and semilunar valves.
- To know the natural history, pathophysiology, and clinical presentation of each major valvular lesion (mitral stenosis and incompetence, aortic stenosis and incompetence, tricuspid stenosis and incompetence);
- To understand the operative and non-operative therapeutic options for the treatment of each major valvular lesion; To know the relative risks of operative and non-operative treatment for valvular heart disease in planning interventions;
- To know the theory of techniques for repair and replacement of cardiac valves;
- To know the theory of the preoperative and postoperative management of patients with valvular heart disease including echocardiograms

General Contents:

- Assessment of Patients with Valvular Heart Disease
 - history and physical examination
 - echocardiogram
- Choice of Treatment
 - valve repair
 - prosthetic valves
 - stented xenografts
 - non-stented human and xenograft valves

- autograft valves for aortic valve replacement

➤ Long Term Complications of Replacement Devices

- thrombosis
- embolus
- Prosthetic dysfunction

VALVE SPECIFIC CONTENTS

Aortic Valve

➤ Normal Anatomy and Function

➤ Aortic Stenosis

- etiology and pathologic anatomy
- natural history and complications
- physiology (ventricular hypertrophy, mitral incompetence)
- medical therapy
- indications for operative intervention (risk stratification)
- techniques of valve replacement and repair
- management of small aortic root
- homograft and autograft valve replacement
- perioperative care considerations
- early and late results

➤ Aortic Incompetence

- etiology and pathologic anatomy
- natural history and complications
- physiology (LV dilatation and LV dysfunction)
- non-operative treatment
- indications for operative intervention
- in absence of clinical symptoms
 - when complicated by endocarditis
 - when complicated by aortic root aneurysm
 - techniques of valve repair and replacement
 - with endocarditis and aortic root abscess
 - with ascending and root aneurysm
 - perioperative care considerations
 - early and late results

Tricuspid Valve

- Normal anatomy
- Normal function
- Tricuspid incompetence
 - etiology and pathologic anatomy
 - physiology
 - indications for operation
 - functional incompetence

- endocarditis
 - techniques of repair, indications for replacement
 - ring and suture annuloplasty
- endocarditis (valve excision vs. repair or replacement)
- perioperative care
 - management of RV dysfunction
 - interventions to decrease pulmonary vascular resistance
- early and late results
- tricuspid stenosis
 - etiology and pathologic anatomy
 - physiology
 - differentiation from constrictive pericarditis
 - indications for operative repair vs. replacement
- techniques of repair and replacement
- early and late results

Mitral Valve

- Normal anatomy
- Normal function
- Mitral stenosis
 - etiology and pathologic anatomy
 - natural history and complications
 - physiology
 - non-operative treatment
 - indications for intervention (risk stratification)
 - merits of balloon valve dilation vs. operative repair or replacement
 - techniques of valve repair and replacement
 - intraoperative and postoperative complications and management
 - early and late results of operative and balloon valvulotomy
- Mitral incompetence
 - etiology and pathologic anatomy
 - natural history and complications
 - physiology (mechanisms of incompetence)
 - non-operative treatment
 - for nonischemic etiology
 - for ischemic etiology
 - indications for surgical intervention (risk stratification)
 - techniques of valve repair
 - ring and suture annuloplasty
 - leaflet plication, excision
 - chordal/papillary muscle shortening
 - chordal transposition and artificial chordae
 - perioperative care
 - early and late results of repair and replacement

Endocarditis

- etiology
- natural history and complications
- medical therapy
- techniques of valve repair and replacement

- aortic root abscess
- Outcome

Combined Valve Lesions

- natural history and complications
- physiology
- non-operative treatment
- indications for surgery (risk stratification)
- techniques of valve repair and replacement
- intraoperative and postoperative complications and management
- early and late results of therapy

CARDIAC ARRHYTHMIAS

Summary:

- To understand the etiology of cardiac arrhythmias and underlying physiologic disturbances;
- To understand operative and non-operative management;
- To know the indications for and techniques of electrophysiologic studies and the application of this information to patient management.

Contents:

Cardiac arrhythmias

- Atrial
 - Ventricular
- Non-operative management
 - Acute post-operative atrial arrhythmias
 - Anti-arrhythmic drugs
 - Electrical cardioversion and pacing
 - Catheter ablation
- Operative management
 - AICD
 - intraoperative mapping and ablation
 - permanent pacing systems

MYOCARDITIS, CARDIOMYOPATHY, HYPERTROPHIC OBSTRUCTIVE CARDIOMYOPATHY

Summary:

- To understand myocarditis (causes, physiologic changes, treatment, prognosis, and radiographic, EKG and echocardiographic changes)

- To understand hypertrophic cardiomyopathy (genetic linkage, pathologic and anatomic changes, physiologic derangements, clinical features, diagnostic tests, natural history, medical and surgical treatment)
- To know the types of cardiomyopathies (causes, natural history, diagnostic methods, operative and nonoperative treatment)
- To be able to evaluate and interpret chest x-rays, CT scans, MRI, echocardiograms, and cardiac catheterizations of patients with myocarditis, cardiomyopathy and hypertrophic cardiomyopathy (HCM)
- To know how to perform operations for the treatment of HCM

Contents:

- Hypertrophic cardiomyopathy (HCM)
 - pathologic changes
 - anatomic changes
 - pathophysiology
 - obstructive vs. non-obstructive
 - arrhythmias
 - diagnosis
 - history and physical examination
 - echocardiography
 - cardiac catheterization
 - mitral valve
 - systolic anterior motion
 - mitral regurgitation
 - treatment
 - myectomy and ventriculo-septoplasty
 - pacing
 - mitral valve replacement
 - outcome
 - complications
 - long-term results

- Cardiomyopathy
 - dilated
 - restrictive
 - pathology
 - pathophysiology
 - diagnosis
 - echocardiography
 - endomyocardial biopsy
 - clinical course
 - treatment and outcome

- Cardiac Transplantation
- Myocarditis
 - pathologic changes
 - etiology
 - clinical findings
 - investigations
 - treatment and outcome

PACEMAKERS

Objectives:

- To understand the indications and contraindications for permanent cardiac pacing;
- To know the techniques and complications of epicardial and transvenous cardiac pacemakers

CARDIAC TRANSPLANTATION

Objectives:

- To acquire basic knowledge of the indications, the medical and surgical management and the immunosuppressive therapy of the cardiac transplantation.

2. Based on Clinical Presentation / Clinical Management

Objectives:

To understand and learn the standard approaches for the most common clinical scenarios

- 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 shunting defects
- Duct dependent systemic circulation
- Obstructive left heart lesions
- Acyanotic obstructive right heart lesions
- Patients with cyanotic congenital heart disease
- Duct dependent pulmonary circulation
- Transposition physiology
- Cyanotic congenital heart disease with high pulmonary flow
- Complex cyanotic congenital heart disease
- Fontan circulation
- Inflammatory cardiovascular 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
- 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

Investigations and Technical Skills

Investigations and Procedures (Paediatric and Adult Cardiology Training)

3.1. Training for Surgeons:

3.2.1 Knowledge

COAGULATION MANAGEMENT AND BLOOD COMPONENT THERAPY

Summary:

- To understand the major blood groups, the clotting cascade, and the pathophysiology of clotting
- To understand the specific hemorrhagic and thrombotic complications of cardiac surgery and their management;
- To understand the methods used in blood component storage and the measures taken to ensure a safe blood supply;
- To understand the use of specific blood components to treat abnormalities of red cell quantity and quality, platelet quantity and quality, and coagulation function;
- To know the preoperative risk factors for excessive blood loss and blood utilization;
- To understand the operative and postoperative techniques to ensure blood conservation.

EXTRACORPOREAL BYPASS AND COAGULATION-BLOOD PRODUCTS

A. Physiology of Extracorporeal Bypass

Summary:

- To understand the physiology and mechanics of membrane and bubble oxygenators;
- To understand the mechanics and operation of roller and vortex pumps;
- To understand the physiology of various extracorporeal bypass circuits and the derangements caused by their use;
- To know the coagulation system and alterations of blood elements;
- To understand the basic design and function of ventricular support devices.

Contents:

- membrane oxygenators
- bubble oxygenators
- roller head pumps
- vortex pumps
- extracorporeal circuits
- perfusion solutions
 - prime solutions
 - hemodilution
 - oxygenators (types, indications, benefits, disadvantages)
 - venous reservoir
 - cardiotomy reservoir
 - tubing (choice of adequate internal diameter)
 - osmotic pressure, oncotic pressure (use of mannitol, albumin)
 - blood gas control

- Manipulation of:
 - flow
 - pressure
 - temperature

B. Techniques of Extracorporeal Bypass

Objectives:

- To understand the standard techniques for extracorporeal bypass;
- To understand the techniques for left heart bypass and right heart bypass for the treatment of specific clinical problems;
- To understand the techniques of cannulation for extracorporeal bypass;
- Oversees the management of patients undergoing extracorporeal bypass.
- To understand the principles of use and the various types of cardioplegia.

Contents:

- Standard cardiopulmonary bypass
 - routes for cannulation (arterial and venous)
 - types of extracorporeal circuits
 - monitoring
 - complications
- Anticoagulation for cardiopulmonary bypass
 - heparin and other agents
 - monitoring
 - reversal
 - complications
- Special situations
 - left and / or right heart bypass
 - profound hypothermia and circulatory arrest
- Cerebral Protection
- Cardioplegia
 - cold and warm crystalloid cardioplegia
 - cold and warm blood cardioplegia
 - crystalloid versus blood cardioplegia
 - routes of cardioplegia

C. CARDIOPULMONARY BYPASS FOR OPERATIONS ON CONGENITAL CARDIAC ANOMALIES

Summary:

- To know the principles of cardiopulmonary bypass for congenital heart disease, the techniques of myocardial preservation, and the use of profound hypothermia and total circulatory arrest and their alternative in the infant and child.

Objectives:

- To know the indications for the various techniques of bypass (anatomy, pathophysiology, and technical requirements of the underlying cardiac defects);
- To know arterial and venous cannulation techniques for different intracardiac defects;
- To understand the techniques of myocardial protection in the neonate and young infant;

- To understand the use of varying levels of hemodilution and anticoagulation;
- To understand perfusion flow and pressure control;
- To know the methods of body temperature manipulation, and the indications for and techniques of profound hypothermia with and without total circulatory arrest.

C. Mechanical Support

OBJECTIVES:

- To gain basic knowledge the indications for cardiac support with mechanical devices or ECMO;

CONTENTS:

- Indications for mechanical support
 - postcardiotomy
 - acute myocardial infarction with balloon-dependent left heart failure
- Respiratory Failure
 - indications for ECMO
- Devices
- Techniques of insertion
- Complications
 - blood trauma
 - thrombosis
 - bleeding
 - infection
- Anticoagulation
 - Requirements for various mechanical devices
 - Detection of blood trauma
 - Early detection of thrombotic problems

Practical Training

Objectives:

- To bring the trainee to a level of total independence in the operating theatre.

Learning Methods:

- Self directed learning (e.g. textbooks, journals and internet sources)
- Dedicated teaching by consultant staff (e.g. period of tuition by cardiac surgeon(s) / fellows and / or registrars)
- Hospital meetings (e.g. surgical conferences)
- Local postgraduate education (e.g. departmental teaching, journal review, grand round presentations)
- Attendance (or presentation of research) at regional, national and international conferences

- Apprenticeship learning (experiential learning)
- Participation in research or audit supervised by consultant trainer
- Participation in teaching
- Participation in management

Assessment Methods:

This will document assessments carried out by training consultants and may include:

- Evaluation by the trainee's educational supervisor
- Evaluation by a consultant other than the trainee's educational supervisor
- Each of whom may carry out an assessment by:
 - (i) direct observation of the trainee
 - (ii) Discussion with other staff members
 - (iii) Discussion with patients and their parents
- Inspection of the trainee's log book (which should record every investigation or procedure performed by the trainee)
- Evaluation of the trainee's critical reflection on events in clinical practice